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June 1981
Final Report

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U.S. Department of Transportation
National Highway Traffic Safety Administration

An Evaluation of Existing Motor Vehicle Diagnostic Inspection Concepts

Volume II: Characteristics of Motor Vehicle Diagnostic Inspection Facilities

COMPLETED
458

Booz-Allen & Hamilton, Inc.
Transportation Consulting Division
Bethesda, Maryland 20014

Contract No. DTNH22-80-C-05018
Contract Amount $282,442

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16. Abstract

This report presents the results of Task 1 of the Evaluation of Existing Diagnostic Inspection Concepts, Contract No. DTN H22-80-C-05018. The focus of this report is the detailed documentation of 30 motor vehicle diagnostic inspection facilities or programs in the United States, Canada, and selected foreign countries. Comprehensive data on the 30 facilities, including layouts and architectural features, equipment, inspection hiring and training provisions, vehicle processing capabilities, quality control techniques and measures of effectiveness are contained in the detailed appendices. The body of the report contains summary analyses of the major groups of diagnostic facilities: U.S. and Canadian auto clubs, commercial diagnostic inspection facilities, diagnostic demonstration projects, a cooperative diagnostic facility and auto clubs in Europe, Australia, and New Zealand.

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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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*1 in ≡ 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

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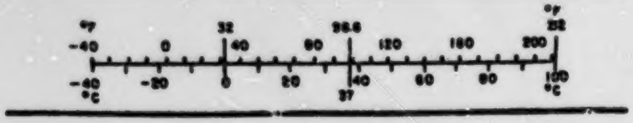
Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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I. INTRODUCTION

This report presents the results of the first task in a contract to develop feasible concepts for supplementing periodic motor vehicle inspection programs with a diagnostic inspection capability. The first task involved the collection and analysis of detailed information on major diagnostic inspection facilities and systems, both in the U.S. and other countries. Subsequent tasks, documented in separate volumes, included the following activities:

- Task 2 involved the collection of detailed data on existing and planned mandatory vehicle inspection programs which are conducted primarily to determine vehicle compliance with statutory safety, emissions and/or noise requirements.
- Task 3 involved the development of alternative concepts for supplementing the mandatory vehicle inspection programs with a diagnostic capability.
- Task 4 involved the preparation of a diagnostic inspection program planning manual. The manual is suitable for use by State, local and consumer organization planners who are interested in implementing a diagnostic inspection capability in existing or future inspection facilities.

Completion of the first task involved the collection, organization and analysis of extensive data on 30 diagnostic inspection facilities/programs in seven countries. All of the data was collected first hand from the facility owners or managers, with the exception of the federally funded diagnostic inspection demonstration projects conducted from 1975 to 1977. Aside from the reports on those five projects, very little information on diagnostic facility operations has been published. Thus, extensive information is included in this volume.

Objective

The objective of this report is to summarize and evaluate comprehensive data on principal motor vehicle diagnostic inspection facilities and programs. These facilities and programs include U.S. and foreign auto clubs, commercial diagnostic/repair facilities, cooperative diagnostic repair facilities and the federally funded motor vehicle diagnostic inspection demonstration projects.

For each program, available data on the following topics was collected and analyzed:

- Facility Size and Architectural Considerations
- Equipment
- Inspector Staffing/Training Provisions
- Customer Counseling and Other Services
- Vehicle Processing Capability
- Community Interaction
- Quality Control Techniques
- Means for Preventing Technical Obsolescence
- Measures of Effectiveness.

Detailed data on individual facilities is presented in the Appendix. The body of the report presents a summary analysis of each major group of facilities.

Methodology

The methodology for documenting the diagnostic facilities included on-site visits, personal and telephone interviews and the examination of reports, technical papers, inspection forms and diagrams provided by the facility managers. Data on all of the facilities except the diagnostic inspection demonstration projects was collected directly from the facility owners or managers during a four-month period from June to September, 1980. Information on the demonstration projects was taken from reports published by the government, technical contractors and the demonstration site operators. All of the collected data was then assembled into appendices which are presented in a uniform format, and summary analyses of the data were prepared for inclusion in the body of this report.

The amount of available information varied considerably among the different types of facilities. The auto clubs in the U.S. and Canada were very responsive in providing information to the level of detail required for the study. The commercial diagnostic facilities, on the other hand, were all being operated as part of auto repair businesses; thus their owners had less time available to discuss the programs. Few of the commercial diagnostic facilities could provide facility diagrams or detailed information on provisions for inspector training, quality control techniques, inspection process times or inspection effectiveness.

Information on the overseas diagnostic facilities was received in response to letters sent to auto club headquarters in Europe, Australia and New Zealand. General descriptions of facility operations in these foreign countries, with some detailed layouts, are presented. The information received in response to these inquiries is not as detailed as the information collected through personal interviews in the U.S. and Canada. Assistance from the National Headquarters of the American Automobile Association was provided in many cases, to document the foreign operations.

Organization of the Report

The report is organized into six chapters and five appendices. A full chapter plus an appendix is dedicated to each of the five major groups of diagnostic inspection facilities. The chapters and appendices are organized as follows:

Chapter I - Introduction	
Chapter II - Characteristics of U.S. and Canadian Auto Club Diagnostic Inspection Facilities (9 Facilities)	Detailed data contained in Appendix A
Chapter III - Characteristics of Commercial Diagnostic Inspection Facilities (10 Facilities)	Detailed data contained in Appendix B
Chapter IV - Characteristics of Motor Vehicle Diagnostic Inspection Demonstration Projects (5 Facilities)	Detailed data contained in Appendix C
Chapter V - Characteristics of a Cooperative Diagnostic Inspection Facility (1 Facility)	Detailed data contained in Appendix D
Chapter VI - Characteristics of Overseas Auto Club Diagnostic Inspection Facilities (5 Countries)	Detailed data contained in Appendix E

The data in Appendices A through D is presented in a uniform format which documents all available information on each facility. Appendix E primarily contains copies of the diagnostic inspection checklists used at each of the foreign clubs.

Illustrations of facility layouts, inspection checklists, diagnostic report forms, price lists, repair prescription forms and other exhibits are contained in the appendices for each facility and are not duplicated in the body of the report. Readers should refer to the appendices for detailed examples of the material summarized in the text.

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II. CHARACTERISTICS OF U.S. AND CANADIAN AUTO CLUB DIAGNOSTIC INSPECTION FACILITIES

This chapter summarizes the characteristics and effectiveness of typical auto club diagnostic inspection facilities. These facilities are operated by local organizations of the American Automobile Association as a service to their members. The majority make their diagnostic facilities available to non-members as well.

The auto club facilities are the most sophisticated and well-staffed of existing diagnostic facilities. They maintain high standards for their personnel, equipment selection and inspection procedures. The facilities are not required to be self-supporting; thus most are subsidized through other club revenues.

The following section introduces nine auto club facilities which were examined for this study, and provides a brief description of each. Succeeding sections summarize characteristics of the facilities which may be pertinent to the development of diagnostic concepts for existing and planned vehicle inspection programs. All details of the individual facilities, including layouts, data collection forms, staffing levels and equipment model numbers are contained in the detailed description of each facility in Appendix A.

The remaining parts of this chapter are presented in the following sections:

- Introductory Profile of Diagnostic Facilities
- Facility Layout and Architectural Considerations
- Equipment
- Facility Staffing/Training Provisions
- Customer Counseling and Other Services
- Vehicle Processing Capability
- Community and Repair Industry Interaction
- Quality Control Procedures
- Measures of Effectiveness.

INTRODUCTORY PROFILES OF AUTO CLUB FACILITIES

Nine auto club diagnostic facilities were studied, five in the U.S. and four in Canada. A brief description of each of the nine facilities is presented below:

- Baltimore. The AAA of Maryland operates a mobile diagnostic van in the Baltimore community. The van is a Ford partial delivery van equipped with a Sun 2001 engine analyzer, an emission analyzer and a starter tester. Diagnostic inspection services include an engine, charging and starting diagnostic test for $21.95 and a charging and starting test for $7.95. (1980 prices).

- Philadelphia. The Keystone Auto Club opened its diagnostic facility in Broomall, a suburb of Philadelphia, on June 30, 1980. The station contains four parallel open bays through which vehicles are routed for optimum throughput and inspection efficiency. Major equipment includes a Clayton brake tester/dynamometer, a Hunter front end analyzer and a Sun Computer II-1215 engine analyzer. A complete vehicle diagnostic inspection performed for members is $30.00.

- St. Louis. The St. Louis Diagnostic Clinic is the largest auto club diagostic facility in the United States. The facility contains eight bays with six lifts in addition to two lanes and an observation area for customers. Equipment at the facility includes two Clayton brake analyzer/dynamometers, two Hunter dynamic wheel alignment testers and two Clayton chassis dynamometers. A "main lane" diagnostic inspection including an underhood and underbody inspection is $30.00 for members.

- Toronto. The Ontario Motor League operates a diagnostic inspection facility in Toronto. The facility contains four lifts at the first station which feed into a headlight tester, chassis dynamometer and dynamic front end alignment machine. Diagnostic inspection is $38.50 for members (Canadian dollars).

- Vancouver. A new stationary facility was opened by the British Columbia Auto Association in the Spring of 1981. The inspection center is similar to the Toronto Club, with three hoists feeding into a headlamp tester, wheel alignment machine, and a combination dynamometer/ brake analyzer. The planned diagnostic inspection fee is $35.00 (Canadian dollars) for members.

- Montreal. A two-bay diagnostic facility in Montreal provides a modified diagnostic inspection which includes engine and emission analysis, a wheel removal brake inspection and a headlamp aligment test. The facility is equipped with two engine analyzers, hydraulic lifts, emission analyzers and an optical headlamp aimer. A diagnostic inspection is $25.00. (Canadian dollars).

- Sainte-Foy. This two-lane facility opened in January, 1980 in Sainte-Foy, Quebec. The auto club performs limited repairs as well as inspections. Equipment includes a Clayton combination brake analyzer/ dynamometer, a Hamilton Test System Autosense engine analyzer, and a Bear scuff gauge. Diagnostic inspection for members is $35.00. (Canadian dollars).

- San Jose. The California State Automobile Association (CSAA) facility in San Jose was constructed in 1974. Building codes did not permit drive-through bays, thus the facility has three extra long working bays and one bay dedicated for driving vehicles to the rear of the facility. The facility offers complete and partial vehicle diagnostic inspection and is equipped with an Allen Smartscope engine analyzer, a Hunter F60 dynamic alignment machine, a Clayton dynamometer and Clayton roller brake tester.

- San Francisco. The CSAA facility in San Francisco was constructed in 1968 and has approximately 2,500 square feet of space. Vehicles enter on one side of the building, progress through three working bays and exit on the other side of the building. The club provides dynamic brake analysis, dynamic front end analysis, engine analysis while the vehicle is on a dynamometer and checks of the chassis and steering as well as other systems. Equipment includes a Clayton engine analyzer and Merrill dynamic alignment tester.

FACILITY LAYOUT AND ARCHITECTURAL CONSIDERATIONS

This section describes the facility layouts and noteworthy architectural features of the diagnostic inspection facilities. The information on the nine facilities is presented in the following sections:

- Facility size and layout
- Safety accommodations
- Noise reduction and ventilation accommodations
- Other architectural features.

Facility Size and Layout

The nine auto club diagnostic facilities include one mobile and eight stationary facilities. The amount of floor space devoted to inspection in the stationary facilities ranges from

600 square feet in Monteal to 6,180 square feet in St. Louis; the average is approximately 3,942 square feet of inspection floor space per facility. Details of the facility size and layout for each of the facilities are provided below.

Facility Size

Table II-1 summarizes the overall dimensions of the individual facility lanes and bays and gives the total floor space dedicated to inspection and auxiliary activities at each facility. Total building areas of the inspection facilities range in size from the smallest, 1,100 square feet in Montreal, Quebec to the large 10,000 square foot facility recently opened in Vancouver, British Columbia. The largest currently operating U.S. facility is in St. Louis, Missouri, which has a total area of 8,400 square feet.

Ratios of inspection areas to auxiliary facility space (including offices, reception areas and restrooms) range from 3.2:1 in Saint-Foy, Quebec to 1.5:1 in both Montreal, Quebec and Vancouver, British Columbia. The average ratio of inspection areas to auxiliary floor space for the six permanent inspection facilities is 2.3:1.

Facility Layout

Figure II-1 summarizes the general facility layouts for the nine auto clubs. The inspection station designs include a bay-type facility which is similar to a repair garage (Montreal), a large facility containing two lanes and eight bays (St. Louis), and several facilities in which two, three or four lanes merge into one or two lanes (Toronto, Vancouver and Sainte-Foy).

The Keystone Auto Club in Philadelphia is designed in four flow-through bays through which vehicles are circulated from one inspection procedure to the next. A separate bay is reserved for trouble-shooting difficult problems. This design approach was recommended by three auto club directors as a preferred approach to the traditional lane layout. In a lane-type facility, additional trouble-shooting or problem analysis tends to reduce overall lane throughput. With the flow-through bay design, extra time can be spent on individual vehicles with minimal reduction in overall throughput.

Safety Accommodations

Managers of U.S. diagnostic facilities conform with general industry safety and health standards established by the U.S.

TABLE II-1. SIZE OF AUTO CLUB DIAGNOSTIC FACILITIES

Location of Auto Club	Number of Lanes	Lane Dimensions (Feet)	Number of Bays	Bay Dimensions (Feet)	Total Inspection Floor Space (Square Feet)	Auxiliary Floor Space (Square Feet)	Total Facility Area (Square Feet)	Ratio of Inspection Area to Auxiliary Floor Space
Baltimore, Maryland*								
Philadelphia, Pennsylvania	-	-	4	50 x 15	3,000	1,500	4,500	2:1
St. Louis, Missouri	1 1	175 x 12 60 x 12	8	35 x 12	6,180	2,200	8,400	2.8:1
Toronto, Ontario	2 2	120 x 15 60 x 15	-	-	5,400	1,800	7,200	3:1
Vancouver, British Columbia**	1 1	100 x 45 100 x 15	-	-	6,000	4,000	10,000	1.5:1
Montreal, Quebec	-	-	2	25 x 12	600	400	1,000	1.5:1
Sainte-Foy, Quebec	2	65 x 28	-	-	3,640	1,137	4,777	3.2:1
San Jose, California	-	-	3	24 x 70	5,040	2,000	7,040	2.5:1
San Francisco, California	-	-	3	14 x 40	1,680	800	2,480	2:1

* Inspections are conducted at the immediate rear of the mobile van. The estimated working area is 12 feet by 7.5 feet. Approximately nine square feet of set-up space is required.

** Planned facility.

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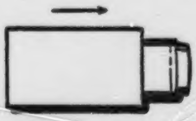
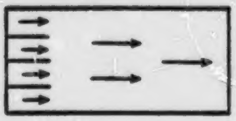
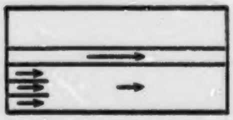
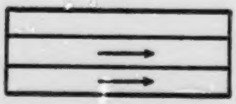
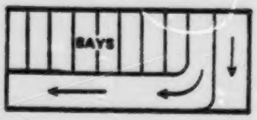
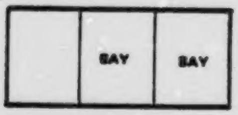
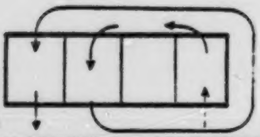
TYPE OF FACILITY LAYOUT	AUTO CLUB FACILITY LOCATION	SCHEMATIC OF INSPECTION AREA
Mobile Van	Baltimore, Maryland	
Lane	Toronto, Ontario	
Lane	Vancouver, British Columbia	
Lane	Sainte-Foy, Quebec	
Lane Plus Bay	St. Louis, Missouri	
Working Bay	Montreal, Quebec	
Flow Through Bay	Philadelphia, Pennsylvania San Jose, California San Francisco, California	

FIGURE II-1. AUTO CLUB FACILITY LAYOUTS

Occupational Safety and Health Administration.* In Canada, the Ministry of Labor's safety standards are observed. No specific safety standards have been developed for diagnostic inspection facilities in either the U.S. or Canada.

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* The general industry standards are specified in OSHA Safety and Health Standards, 29 CFR 1910, reivsed November 7, 1980.

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The occupational safety standards address walking and working surface conditions, exit access, environmental control, control of hazardous materials, availability of personal protective equipment, first aid, fire protecion, machinery guards, electrical codes and toxic substances. These codes ae observed in all of the diagnostic facilities by such provisions as adequate fire extinguishers, exit access in case of fire, clean and orderly working areas and adequate sanitation. Table II-2 lists additional safety accommodations identified by the diagnostic facility managers as particularly important in their own inspection facilities. These include the use of goggles and face masks to protect the inspectors and provding training in industrial first aid techniques.

TABLE II-2. TYPES OF SAFETY ACCOMMODATIONS FOUND IN AUTO CLUB DIAGNOSTIC FACILITIES

1. General fault interceptors in electrical hook-ups.
2. Properly insulated wiring.
3. Correct size bolts for anchoring testing equipment.
4. Stair treads painted yellow and equipped with grips.
5. Safety glass separating the patron lounge/viewing area from the inspection area.
6. Regulation nozzles on compressed air hoses.
7. Protective face masks for inspectors when checking ignition timing under loaded mode. The mask protects against poorly connected moving parts that may fly off the engine.
8. Wiring of goggles by inspectors when using Foeon or compressed air to protect their eyes from freezing gas or dirt carried by the compressed air.
9. Placing a large sheet of plastic over an engine while the car is on the dynamometer if the fan is suspected of having a loose component.
10. Use of parabolic mirrors on building exterior to increase visibility around corners.
11. Inspector training in industrial first aid techniques.

Noise Reduction and Ventilation

The auto clubs have applied a variety of techniques to combat excessive noise and air pollution levels in the inspection stations. Procedures which are used to reduce noise levels include the following:

- Installation of sound deadening rolls on dynamometers
- Fiberboard covering applied to the inspection station walls
- Suspension of foam noise baffles from the ceiling (covered with a flame retarding material)
- Installation of acoustical walls between the inspection area and the customer waiting lounge.

According to the station managers, the greatest sources of noise are the dynamometers, air guns (for removing wheel nuts) and the hammering of hubcaps back on to the wheels.

Techniques for reducing air pollution levels include installing a ventilation system with intake ducts throughput the inspection area and vents located away from the building. Other techniques currently used by the auto clubs include:

- Installation of louvered exhaust systems behind the dynamometers to collect fumes generated during dynamic tesing.
- Use of auxiliary fans to increase air circulation in work areas and to remove engine heat during engine diagnosis.
- Installation of ducts to constantly purge equipment and working pits with fresh air to remove heat and fumes.
- Installation of carbon monoxide alarms in the inspection area.

Other Architectural Features

Additional diagnostic facility architectural features are designed to reduce facility engery consumption. Skylights can be used to mximize visibility in the working areas and reduce daytime electricity consumption. Diagnostic work areas can be heated with infrared heaters while the reception and office areas can be heated with a heat pump, as in the Keystone Auto

Club in Philadelphia. In winter, heat loss from opening bay and lane doors can be reduced by equipping the doors with sensing devices which will cause them to open and close automatically when a vehicle is driven into the building. The automatic door openers also eliminate time lost during manual door opening.

EQUIPMENT

Equipment in the auto club diagnostic facilities is described in the following sections:

- Test equipment
- Data processing equipment.

Test Equipment

The number of units of major test equipment in each of the nine auto club diagnostic facilities is shown in Table II-3. Major types of equipment include the following:

- Engine analyzers
- Emission analyzers
- Alignment testers
- Optical headlight testers
- Brake analyzers
- Dynamometers.

Each of the diagnostic facilities has at least one engine analyzer, and the facilities in Philadelphia, St. Louis and Toronto have two, five and five engine analyzers respectively. Common analyzer models include the Sun 947 and 1115 units, the Hamilton Test CEA, and the FMC Autoscan.

Six of the nine clubs have at least one emission analyzer and seven of the clubs have optical headlamp aimers. Five of the diagnostic facilities are equipped with Clayton B8-CP200 combination chassis dynamometer/brake analyzers. In addition to this unit, the St. Louis facility is also equipped with a Clayton CP-200 chassis dynamometer and a Clayton brake analyzer.

The Baltimore and Montreal diagnostic facilities have the fewest units of major equipment. Baltimore has two units: the Sun 2001 engine analyzer and the Sun EPA-75 emission analyzer which is used as a back-up unit. Montreal has a Hamilton Test CEA engine analyzer, a Marquette emission analyzer and a Marquette headlamp aimer as its total complement of major equipment.

TABLE II-3. MAJOR TYPES OF TEST EQUIPMENT IN AUTO CLUB DIAGNOSTIC FACILITIES

Auto Club Location	Number of Units																															Total Units
	Engine Analyzers											Emission Analyzers							Brake Analyzers/ Dynamometers			Alignment Testers					Headlamp Testers					
	Allen Smartscope	Sun Computer II-1215	Sun 2001	Sun 1115	Sun TUT-1015	Sun 947	Autoscan 4050	Autoscan 4030	Hamilton Test CEA	Clayton 7000 or 7100	Marquette 40-275	Allen	Sun EPA-75	Horiba GSM-33	MSA	Clayton	Marquette 42-159	Hamilton Test 610 CEA	Clayton Chassis Dyn/Brake Analyzer Combination	Clayton Brake Analyzer	Clayton Chassis Dynamometer	Merrill	Hunter F-70	Hunter F-60	Bear Telatronic 64659	Bear Scuff Gauge	Weaver	Hunter Headlamp Aimer	Hoffman Headlamp Aimer	Marquette Headlamp Aimer	Sun Headlamp Aimer	
Baltimore, Maryland			1										1																			2
Philadelphia, Pennsylvania		1				1													1				1					1				5
St. Louis, Missouri					1	1	2	1						2	1			*	1	1	1			2								13
Toronto, Ontario				3		1				1			3			1			2					1					1			13
Vancouver, British Columbia									1										1						1			1				4
Montreal, Quebec											1						1													1		3
Sainte-Foy, Quebec									1										1							1					1	4
San Jose, California	1											1								1	1			1				1				6
San Francisco, California										1			1							1	1	1					1					6

* Planned Purchase

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The auto club facilities which offer more comprehensive diagnostic inspections have larger inventories of major equipment. The largest inventories are in Toronto, Ontario, and St. Louis, Missouri, which each have 13 units of major equipment.

Other types of testing equipment found among the different facilities include the following:

- Starter tester
- Sound level meter
- Circuit tester
- Wheel spinner
- Distributor tester
- Cylinder leakage tester
- Volt/Amp tester
- Compression gauge tester
- Battery charger
- Cooling system tester.

Data Processing Equipment

Data processing equipment is not used in the currently operating auto club diagnostic inspection facilities. Data collection and forms processing functions are accomplished manually, although managers of diagnostic facilities in Philadelphia and St. Louis have expressed a desire to keypunch and analyze the test data in the future. Specific plans for automating the data have not been formulated.

Managers of the British Columbia Auto Association plan to introduce an automated data collection system after the new facility in Vancouver has been operating for a while. The procedures will include initial data entry at a terminal in the check-in area, and entry of the results of each diagnostic test through small terminals located in the lane. A computer printout of all results will be provided to each motorist following inspection. As of November, 1980, more detailed plans for this system had not been established.

A principal feature of the Hamilton Test Systems Autosense engine analyzer is a computerized printout of the test results in clearly worded English. The amount of automated data processing which this feature adds to the inspection process is the full extent of automation currently found in any of the auto clubs. The Sun Electric Company offers a Sun 2002 Printer with English text printout, which is used by the Baltimore auto club.

FACILITY STAFFING/TRAINING PROVISIONS

Staffing and training provisions of the diagnostic facilities are presented in the following sections:

- Staffing levels
- Inspector employment requirements
- Inspector training provisions.

Staffing Levels

Table II-4 summarizes the staffing levels for each of the nine auto club diagnostic facilities The total number of people employed at each facility ranges from three for the Baltimore, Maryland diagnostic van to 16 at the St. Louis, Missouri diagnostic clinic. The average staff size for all of the clubs is ten, including the following typical number of positions:

- Two people involved in station management, usually one facility director and one station manager

- Four senior inspectors

- Two junior inspectors

- One counselor/diagnostician

- One receptionist/cashier.

In addition to these positions, the facilities in San Jose, San Francisco, Philadelphia, St. Louis and Toronto have a staff supervisor or foreman who supervises the inspectors in the lanes.

The distribution of staff positions varies with the inspection process at each facility. In Philadelphia customer entrance and exit interviews are performed by senior inspectors; thus counselor/diagnosticians are not required. All of the inspectors at the Toronto, Ontario facility are classified as senior inspectors, according to the facility director, so junior level inspectors are not utilized. In Montreal, Quebec, the entire staff consists of two managers and two senior inspectors/mechanics.

Inspector Employment Requirements

Table II-5 summarizes the principal experience, education and skill level requirements for an inspector to be employed at the Baltimore, St. Louis, Philadelphia and Toronto diagnostic

TABLE II-4. DIAGNOSTIC FACILITY STAFFING LEVELS

Staff Positions Auto Club Location	Station Management	Inspector Supervision	Senior Inspector	Junior Inspector	Counselor/ Diagnostician	Clerical	Total
Baltimore, Maryland	1	-	1	1	-	-	3
Philadelphia, Pennsylvania	2	1	3	3	-	1	10
St. Louis, Missouri	2	1	4	5	1	3	16
Toronto, Ontario	2	1	9	-	1	2	15
Vancouver, British Columbia*	2	-	5	-	2	2	11
Montreal, Quebec	2	-	2	-	-	-	4
Sainte-Foy, Quebec	2	-	3	2	1	-	8
San Jose, California	1	1	2	5	-	1	10
San Francisco, California	1	1	3	4	-	1	10
Total Average	2	0	4	2	1	1	10

* Planned.

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TABLE II-5. INSPECTOR SKILL AND TRAINING REQUIREMENTS

Training/Skill Requirements Facility Location and Inspector Level	Practical Automotive Repair Experience (Years)						Training/Education		Certification											Equipment Skills		Automotive Knowledge		Other Requirements
									NIASE									Other						
	1	2	3	4	5	More than 5	1 Year of Automotive Training	2 Year Degree in Automotive Mechanics	Engine Repair	Electrical Systems	Engine Tune-Up	Automatic Transmission	Manual Transmission/Rear Axle	Front End	Brakes	Heating/Air Conditioning	Certified General Auto Mechanic	State Inspector Exam	Certified Mechanic (Canada)	Use of Engine Analyzer for Diagnosing Engine Malfunctions (Including Scope)	Use of a Brake/Chassis Dynamometer	Junior Technician Entrance Exam	Increased Knowledge of Automotive Power Trains (Including the Transmission and Differential)	Good Communication Skills
Inspector Intern (Baltimore)									●	●	▲													▲
Senior Inspector (Baltimore)									▲	▲	▲	▲	▲	▲	▲	▲	▲							▲
Junior Inspector (St. Louis)*	▲	●	●				▲	●		●	●			●	●			▲						
Senior Inspector (St. Louis)**	▲	●	●				▲	●		●	●			●	●			▲		▲	▲		▲	
Junior Inspector (Philadelphia)**									●													▲		
Senior Inspector (Philadelphia)									▲	▲	▲	▲	▲		▲									
Supervisor (Philadelphia)									▲	▲	▲	▲	▲	▲	▲	▲	▲							
Inspector (Toronto)					▲														▲					

▲ Mandatory requirement.

● Additional desirable qualification.

* At least one NIASE certification is required.

** Additional NIASE certification is encouraged.

facilities. The auto clubs in the United States tend to emphasize certification by the National Institute of Automotive Service Excellence (NIASE), while the Toronto club requires its inspectors to be provincially certified mechanics and to have five years of practical automotive repair experience. Entrance requirements vary among the different clubs.

The Philadelphia auto club has developed an entrance level examination for junior inspectors and at least one area of NIASE certification is considered desirable for this position. Senior inspectors in Philadelphia are required to be NIASE certified in at least six repair areas.

At the St. Louis auto club, junior inspectors are required to have at least one year of practical automotive repair experience, one year of automotive technical training, and a passing grade on the State of Missouri inspector exam. To be promoted, the inspector must demonstrate the ability to use the engine analyzer/scope and the brake/chassis dynamometer in diagnosing vehicle malfunctions, and must demonstrate an increased knowledge of automotive powertrains. Additional NIASE certification is encouraged.

The Baltimore auto club requires an inspector intern to have NIASE certification in engine tune-ups and to have good communication skills. A senior inspector must be a NIASE Certified General Auto Mechanic.

Inspector Training Provisions

Inspector training provisions are not formalized in all of the auto club diagnostic facilities. The following are methods employed among those facilities which do provide and encourage inspector training:

- On the job training for junior level inspectors and interns provided by senior inspectors
- On the job supervision and guidance provided by the foreman and/or station manager
- Attendance at local training school technical courses paid by the auto club
- Instruction in test equipment operation provided by the equipment manufacturers
- Preparation courses for NIASE certification including reimbursement for test fees provided by the auto club
- Periodic staff update meetings.

[redacted]

CUSTOMER COUNSELING AND OTHER SERVICE

The communication of inspection results to customers is one of the most important aspects of the auto club diagnostic process. All of the clubs emphasize the importance of good communication of the results, both to the vehicle owner and to the repair industry. Typical counseling and public awareness services provided by the auto clubs are presented in the following sections:

- Pre-inspection interview
- Post-inspection counseling
- Other customer services.

Pre-Inspection Interview

Each auto club customer receives an entrance interview before the vehicle diagnostic inspection is conducted. The interview may take the form of a written vehicle service history or a pre-inspection interview conducted by an inspection facility staff member. Examples of each are described below.

- Vehicle Service History. A vehicle service history is collected for each vehicle that undergoes a diagnostic inspection at the Baltimore, Maryland AAA. A two-page checklist, completed by the customer, identifies basic vehicle data and asks such questions as:

    - How often is the oil/oil filter changed?
    - How often is the engine tuned?
    - How many miles per year is the vehicle driven?
    - Was the vehicle purchased new or used?
    - What grade of fuel is used?

  The checklist also identifies specific performance problems, typical driving cycles, and the sources of most repair work. The vehicle history checklist is consulted by the senior mechanic in evaluating the results of the diagnostic tests, and it is kept on file by the auto club.

- Pre-Inspection Interview. A senior technician conducts a pre-inspection interview with each customer at the Keystone Auto Club in Philadelphia. Basic vehicle identification data, such as vehicle make, model, year, VIN, engine size, odometer reading and types of power options are documented at the top of the diagnostic report form, and special operating problems are noted by the senior technician. These conditions are referenced during the post-inspection counseling session when the same senior technican gives the motorist the diagnostic inspection results.

In other auto clubs the pre-inspection interview is similar to the Keystone approach. In some cases the interview is conducted by a service scheduler or a diagnostician. The diagnostician might conduct both the pre- and post-inspection interviews but not take part in performing the inspection. The Auto Club of Missouri documents pre-inspection interview data on the customer entrance form which includes a list of vehicle symptoms and the types of services requested by the customer.

Post-Inspection Counseling

Debriefing of auto club customers following the diagnostic inspection is provided in the following formats:

- A written copy of the detailed diagnostic test results
- A verbal interpretation of the results and a recommendation of probable repairs
- A list of recommended repairs stated in simple language
- Miscellaneous brochures and other educational tools.

At least two of these approaches are used by each of the nine auto clubs; each provides a written copy of the detailed test results and a verbal interpretation of the results and needed repairs. Several of the clubs supplement this information with written summaries of necessary repairs and/or unusual problems. Further details of each counseling format follow.

Written Copy of Diagnostic Test Results

All auto clubs give their inspection customers a copy of the detailed checklist used during the inspection process. The checklist identifies each parameter and component that is included in the inspection so that the condition of each can be individually distinguished. Most of the clubs use codes for rating different parts, such as these rating systems used in Toronto, Ontario, and St. Louis, Missouri respectively:

✓:	Satisfactory	A:	Satisfactory
O:	Marginal	B:	Borderline
X:	Critical	C:	Critical.

The forms also provide space for the inspector's comments or notes. When a test result includes a quantitative measurement, that data is entered on the form. The Keystone Auto Club checklist, in particular, provides space for the inspector to write the recommended manufacturer's specifications as well as the actual vehicle readings. Samples of the checklists used by each auto club are shown in Appendix A.

Verbal Interpretation of the Inspection Results

The written checklist of inspection results is usually supplemented with an explanation by the counselor or senior technician. The technician briefly reviews the inspection results, points out critical vehicle conditions that require immediate attention and responds to questions raised by the motorist. The duration of these sessions varies from 5 to 15 minutes, according to the complexity and depth of the vehicle's problems and the type of questions asked by the motorist. Several of the clubs try to discourage time consuming (and costly) counseling sessions by not providing chairs in the counseling area. In response to customer requests for recommendations of repair facilities, the counselors may provide a list of AAA-approved facilities but will not recommend a particular location. Some of the Canadian Club representatives provide a rough estimate of repair costs if specifically pressed by the customer; the U.S. clubs prefer to have customers obtain estimates from the repair industry.

Written List of Recommended Repair Actions

In addition to the written test results, several of the auto clubs provide motorists with a list of recommended repairs. The Keystone Auto Club provides a two-page form which lists commonly required engine, brake, tire, steering, suspension and wheel alignment repairs marked either "required" or "urgent." The form also allows space for the technician to write in specific instructions, if necessary. According to a club spokesman, the Keystone Auto Club encourages its customers to show the simply worded repair prescription to the repair facility rather than the detailed diagnostic checklist since the latter contains technical data that is not understood by all mechanics. The Baltimore Auto Club provides its customers with a defect report which identifies severe, moderate and minor defects and provides appropriate repair and adjustment instructions. At the Auto Club of Missouri, the counselor analyzes the test results and dictates a prioritized set of repair instructions which are then typed before they are given to the motorist.

Other Educational Tools

Some of the auto clubs have developed additional services designed to help the customer understand the diagnostic test results. The Baltimore mobile van is equipped with a wall display of defective emissions and fuel economy control devices and other engine components. This display is used as a visual aid during the counseling session. The same van has charts on the wall which illustrate the inspection procedures. In addition, each customer receives a booklet, "Facts About the Diagnostic Laboratory Engine Test," which explains the diagnostic terms and procedures. In their customer lounge the Auto Club of Missouri provides a slide program which explains the procedures of the diagnostic lane. The Keystone Club in Philadelphia has developed written explanations of two vehicle problems which are not commonly understood by the public, "tire pull" and "brake fluid vapor lock." When the diagnostic tests identify these problems, the technician provides the vehicle owner with a copy of the written explanation and thereby avoids a potentially lengthy explanation.

Other Customer Services

Several of the Auto Clubs file copies of the diagnostic test results by the motorist's name and vehicle type so that a diagnostic history is maintained on each car. The Baltimore Club reviews the files and sends each customer a reminder card when a year has passed since the last check-up. When a customer makes an appointment the Club also sends out a card reminding the motorist of the scheduled time.

The Keystone Auto Club attaches a diagnostic inspection sticker to the air cleaner following an inspection. The sticker identifies the car and the date of the diagnostic inspection. Other auto club services include a full range of brochures and literature on fuel saving tips, the AAA repair facility approval program and consumer interest publications provided by State or local consumer agencies.

The Auto Clubs do not provide "free" vehicle adjustments or repair services. The Auto Club of Missouri will add engine oil and brake or transmission fluid if necessary to assure safe operation of the vehicle during testing. The cost of the replacement fluid is added to the customer's bill. The Quebec Auto Club Diagnostic Center in Sainte-Foy, Quebec provides limited brake and tire repairs at a rate of $24.00 per hour (1980 dollars).

VEHICLE PROCESSING CAPABILITY

The productivity of a diagnostic inspection facility is measured by the number of vehicles processed per day. This section describes the vehicle processing capabilities of the diagnostic facilities in the following sections:

- Processing time per vehicle
- Total vehicle handling capacity.

Processing Time Per Vehicle

Estimates of the average processing time per vehicle at the auto clubs are shown in Table II-6. The estimates were provided by the station managers or other Auto Club representatives.

TABLE II-6. AVERAGE PROCESSING TIME PER VEHICLE

Auto Club Location	Average Processing Time Per Vehicle		
	Inspection (Minutes)	Counseling (Minutes)	Total Process (Minutes)
Baltimore, Maryland	30	15	45
Philadelphia, Pennsylvania	45	15	60
St. Louis, Missouri	60	15	75
Toronto, Ontario	90	15	105
Vancouver, British Columbia*			
Montreal, Quebec	57	10	67
Sainte-Foy, Quebec	85	10	95
San Jose, California	40	5	45
San Francisco, California	40	5	45
Average For All Facilities	56	11	67

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* The Vancouver facility was not operating when this report was prepared. All other vehicle processing times are estimates provided by the station managers.

The average processing time for all facilities is 67 minutes, with 56 minutes for the inspection and 11 minutes for counseling. Inspection times range from an average of 30 minutes at the Baltimore, Maryland mobile van to 90 minutes in Toronto, Ontario. Counseling times are roughly estimated by the station managers at 5 to 15 minutes per customer. All of the station managers emphasized that actual per vehicle processing times vary extensively according to the age and condition of the vehicle. Newer cars may be quickly diagnosed, while some older veicles require extensive troubleshooting to detect some engine and underbody problems.

Total Vehicle Handling Capacity

The average vehicle processing capabilities for each of the auto clubs are summarized in Table II-7. Total vehicle handlings range from 12 per day in the Sainte-Foy, Quebec inspection facility to 50 per day in the St. Louis facility.

The stations with the fewest inspectors (two inspectors each at Baltimore and Sainte-Foy) process the highest number of veicles per inspector--eight vehicles per inspector per day in Baltimore and 7.5 in Montreal. These vehicle handling rates are higher than the rates of the larger facilities staffed with 10 inspectors, St. Louis and Toronto, which inspect an estimated five and 4.1 vehicles per inspector per day respectively. The total vehicle handlings at the larger facilities are, however, greater than at the small facilities.

A probable explanation for the differences in number of vehicle handlings per inspector between the large and small facilities is that the larger facilities provide a more extensive diagnostic inspection. The Baltimore inspection is limited to engine, charging and starting parameters and Montreal inspects engine parameters, brakes and headlamps. Neither Baltimore nor Montreal tests vehicles on a dynamometer.

The average number of vehicles handled per day for all of the auto clubs is 28, with an average of six inspectors per facility and 4.7 vehicles processed per inspector per day.

COMMUNITY AND REPAIR INDUSTRY INTERACTION

Official involvement in community organizations and projects is not characteristic of auto club diagnostic facilities. Seven diagnostic club directors acknowledged that the facilities did not maintain memberships in the Chamber of Commerce, Better Business Bureau or other civic organizations. However, a few examples of other types of community involvement were identified.

TABLE II-7. AVERAGE VEHICLE PROCESSING CAPABILITY

	Average Number of Inspectors/ Facility*	Average Number of Vehicles/ Inspected/Day	Average Number of Vehicles/ Inspector/Day
Baltimore, Maryland	2	16	8.0
Philadelphia, Pennsylvania	7	22	3.1
St. Louis, Missouri	10	50	5.0
Toronto, Ontario	10	41	7.5
Montreal, Quebec	2	15	2.4
Sainte-Foy, Quebec	5	12	2.4
San Jose, California	8	35	4.4
San Francisco, California	8	35	4.4
Average For All Facilities	6.5	28	4.7

* Inspector skill levels are as follows:

Baltimore: 1 Technical mechanic, 1 mechanic intern
Philadelphia: 1 lane supervisor, 3 senior inspectors, 3 junior inspectors
St. Louis: 1 Foreman, 4 lead technicians, 5 junior technicians
Toronto: 1 Chief inspector, 9 master mechanics
Montreal: 2 Master mechanics
Sainte-Foy: 3 Master mechanics, 2 junior mechanics.
San Jose: 1 Assistant Superviser, 2 Senior technicians, 5 junior technicians.
San Francisco: 1 Assistant supervisor, 3 senior technicians, 5 junior technicians

These numbers are used by each facility in calculating throughput capacity and may not necessarily match the total staffing levels defined in Appendix A for each facility.

The Baltimore Auto Club participated in a community service project with the American Lung Association (ALA). From 1972 to 1976 these organizations jointly sponsored free emissions tests for 10,000 automobiles to publicize the need to reduce automobile pollution. Funding for the project was provided by both the AAA and the ALA.

Other examples of community involvement can be seen in the personal activities of the auto club diagnostic facility directors. Mr. William R. Norris, Director of Automotive Services for the Baltimore AAA, is a member of the Board of the local automotive technical school, the Lincoln Technical Institute. In this capacity he reviews candidates for scholarship to the Institute. Mr. Jack E. Weber, Jr., Director of the Keystone Auto Club Diagnostic Clinic in Philadelphia, attends bi-monthly dinner meetings with local businessmen who are concerned about maintaining high levels of technical competence among repair professionals. The Keystone Club also sponsors periodic evening orientation seminars to familiarize the repair industry with diagnostic center operations. The St. Louis Auto Club also holds special sessions to explain the operations and services of the diagnostic facility to the repair industry. Other auto club directors said that they would be responsive to any inquiries from repair business or consumer interest groups and referenced the consumer protection services that are provided to all AAA members.

QUALITY CONTROL PROCEDURES

All of the auto clubs depend on the skills and knowledge of their senior staff members to ensure that high quality inspections are always performed. The senior inspectors have considerable expertise, but they are strongly encouraged to attend technical training seminars and to work at updating their knowledge of the rapidly changing automotive technologies.

Other means of providing quality assurance include maintaining the test equipment in good condition and replacing equipment when its useful life has expired. The managers of the auto club diagnostic facilities were queried about their quality control procedures. Their responses are presented below in the following sections:

- Equipment maintenance and calibration
- Equipment replacement
- Independent quality review.

Equipment Maintenance and Calibration

Table II-8 shows the frequency of diagnostic equipment maintenance and the frequency of gas calibration for emission analyzers at the auto clubs. Most of the clubs perform as many maintenance procedures as possible using in-house inspection staff and the clubs maintain inventories of spare parts for this purpose. Service contracts with equipment manufacturers are employed in Montreal.

TABLE II-8. EQUIPMENT MAINTENANCE AND CALIBRATION SCHEDULE

	Scheduled Equipment Maintenance								Scheduled Gas Calibration of Emission Analyzer							
	Daily	Weekly	Bi-Weekly	Monthly	Bi-Monthly	Quarterly	Semi-Annually	Annually	Daily	Weekly	Bi-Weekly	Monthly	Bi-Monthly	Quarterly	Semi Annually	Annually
Maryland AAA (Baltimore)				x[1]								x				
Missouri Auto Club (St. Louis)					x								x			
Keystone Auto Club (Philadelphia)[2]						x						x				
Ontario Motor League (Toronto)		x[3]		x[4]						x						
Montreal Club (montreal)				x[5]											x	
Quebec Auto Club (Sainte-Foy)				x								x				
San Jose, California	x								x							
San Francisco, California	x								x							

[1] Equipment is serviced at the manufacturer's service center monthly.

[2] Opened June 30, 1980. All equipment is new and still receiving manufacturer service.

[3] Dynamometer and hoist only.

[4] Front end analyzer only.

[5] Under a manufacturer's service contract, the equipment is maintained monthly in the summer and bi-monthly in the winter.

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The predominant interval between equipment maintenance procedures is one month. Auto clubs in Baltimore, Toronto, Montreal and Sainte-Foy service the equipment at this frequency. The new equipment at the Keystone Auto Club in Philadelphia is being serviced by the equipment manufacturers at specified intervals of 30 days for the first few months. every 90 days for up to six months and every 180 days thereafter. The director of the facility is evaluating the need for more frequent maintenance by in-house staff.

Gas calibration of emission analyzers is performed monthly by three of the clubs; the Toronto diagnostic clinic calibrates its emission analyzers weekly and Montreal calibrates semiannually. All of the clubs perform equipment maintenance procedures or calibration if any sign of defect is observed in the equipment. Daily equipment checks before inspection and frequent electronic span checks of emission analyzers are standard operating procedures in all of the diagnostic facilities.

Equipment Replacement

Three of the auto clubs are new or still under construction; the Sainte-Foy, Quebec facility opened in January, 1980, the Philadelphia, Pennsylvania facility opened in June, 1980 and the facility in Vancouver, British Columbia will be completed in the spring of 1981. These facilities are furnished with new equipment and have no immediate plans for replacement.

The St. Louis, Missouri auto club is planning to purchase a new emission analyzer to replace one of the existing units. The Montreal Club has no plans to replace any equipment. The Baltimore, Maryland and Toronto, Ontario clubs have the most aggressive equipment replacement plans. These clubs plan to purchase new engine analyzers when the current equipment is four years old in Baltimore and five years old in Toronto. The Baltimore facility is equipped with a Sun 2001 engine analyzer, while Toronto has a Clayton 7100 and four Sun units (models 947 and 1115). Toronto is planning to update its engine analysis capabilities with an FMC Autoscan analyzer. Both clubs view the purchase of new equipment as a technique for avoiding technical obsolescense of their facilities and staff.

Independent Quality Reviews

The Auto Club of Missouri has contracted with an independent firm, Washington University Technical Associates, to provide quality control checks on the inspection lanes. The firm provides a conventional automobile to be inspected by

Washington University Technical Associates staff and the auto club station manager. Then the car is processed through the clinic and diagnosed by the inspectors. The two diagnostic reports are compared and discussed with the clinic inspectors. Following the discussions the inspectors are given an opportunity to repeat the inspection and to observe any defective conditions which they may have overlooked or misdiagnosed.

The quality control checks are performed four times a year. Washington University Technical Associates provides a written analysis of the types of inspector judgment errors which occurred during each check. This data may be used by the station manager and lane supervisor during staff update meetings or to evaluate inspector performance.

MEASURES OF EFFECTIVENESS

The auto clubs depend on feedback from their customers and on evaluations of the accuracy of repairs to provide a measure of their effectiveness in providing diagnostic inspections. The Baltimore, Maryland Auto Club sends 25 to 35 questionnaires to its customers every month. According to the Director of Automotive Services, William R. Norris, the club is highly rated for the engine, charging and starting inspections it currently provides, but the questionnaires indicate that many customers would like to see the service expanded to a full vehicle inspection. Mr. Norris also points out that the club has observed an increase in the percentage of repair work that is performed correctly. When the program was first started, according to Mr. Norris, approximately 10 percent of vehicles were repaired correctly the first time. Recently this percentage has increased to 50 percent, based on the results of reinspections performed at the mobile van.

The Toronto, Ontario auto club also distributes survey forms to its customers. The complaint rate is considered a measure of the club's effectiveness in serving its members. Complaints about the diagnostic clinic have been made by approximately four out of 1,000 diagnostic clinic customers.

A general observation by the Auto Club of Missouri in St. Louis station manager, Wayne Young, is that the number of items repaired correctly the first time has increased but is still less than satisfactory. The club plans to analyze reinspection data in the future and possibly will implement a system for tracking the performance of individual repair facilities.

III. CHARACTERISTICS OF COMMERCIAL DIAGNOSTIC INSPECTION FACILITIES

This chapter presents a summary analysis of the characteristics and effectiveness of ten commercial diagnostic inspection facilities. All offer one or more diagnostic inspections as well as performing auto repairs.

The immediate next section provides a brief introduction to each facility; subsequent sections analyze selected characteristics of the facilities, both individually and as a group. A detailed summary of each facility is provided in Appendix B. The chapter is organized in the following sections:

- Introductory Profiles of Facilities
- Facility Layout and Architectural Considerations
- Equipment
- Facility Staffing/Training Provisions
- Customer Counseling and Other Services
- Vehicle Processing Capability
- Community Interaction
- Quality Control
- Measures of Effectiveness.

INTRODUCTORY PROFILES OF FACILITIES

Ten commercial diagnostic inspection facilities were evaluated, nine in the United States and one in Toronto, Canada. Two of the facilities were closed (in 1975 and 1979) while the other eight were still performing diagnostic inspections in 1980. A brief introductory synopsis of each of the ten facilities is presented below.

- Auto Lab. This seven-bay repair facility was opened in 1972 in Mt. Clair, California. In addition to the diagnostic lane and repair bays, the owner operates a training school on the premises for mechanics and diagnosticians. The diagnostic lane is equipped with a chassis dynamometer, engine analyzer and front end lift, and also includes an inspection pit. A vehicle diagnostic inspection of 144 items is offered for $24.95.

- Automotive Evaluation Center. At the Automotive Evaluation Center the diagnostic lane and fourteen repair bays are located in separate buildings on a three-quarter acre lot. The facility has been operating in Long Beach, California since 1966. The diagnostic lane includes a brake/chassis dynamometer, an engine analyzer, scuff gauge and lift, and processes 8 to 10 cars per day. The vehicle diagnostic inspection is offered for $21.00.

- Automotive Performance Specialists. This small repair facility is operated by the owner and two apprentice mechanics in a warehouse facility in Newington, Virginia. The facility is not segmented into bays and does not have a lift. The diagnostic service (100 items checked) is requested by motorists who are considering the purchase of a used car. The price for the inspection is $30.00.

- Avocation, Ltd. This Northern Virginia repair facility specializes in engine diagnosis/repairs and performs very little other mechanical work. A two-classroom "Automotive Academy," also located on the premises, instructs mechanics in automotive diagnosis and emission control, among other topics. Diagnostic inspections are performed in the same area as the repair work and include a typed analytical report on the condition of the automobile. The fee for an engine diagnosis is $28.50.

- Call Carl. Of thirteen Call Carl repair/service stations in the Washington, D.C. metropolitan area only one operates a diagnostic lane. The lane was added to the repair station in 1965. A single diagnostician operates the lane which includes a brake/chassis dynamometer, dynamic alignment machine, engine analyzer and a lift. A complete diagnosis (150 items) is available for $21.95.

- CARDOC. The CARDOC diagnostic inspection and repair facility operated for nine years in La Mesa, California and was closed in 1975. The 16 repair bay facility included a diagnostic lane equipped with a lift, dynamic alignment machine, dynamic brake analyzer and engine analyzer. Retired military personnel trained in diagnostic techniques performed the inspections.

- Imperial Esso. This diagnostic clinic is one of about 35 still operated by Imperial Esso in Canada. According to a company spokesman the diagnostic facilities have never been self-supporting. The lane is located in the same building with 12 repair bays and includes a pit, a brake/chassis dynamometer and an engine analyzer. A diagnostic inspection is available for $19.95 (Canadian dollars).

- J.C. Penney. The single remaining J.C. Penney's diagnostic lane is located in Wilmington, Delaware. Customer demand for diagnostic inspections there is so low that only two appointments are scheduled per day, and the single diagnostician doubles as a service manager when he is not in the lane. The lane is equipped with a brake/chassis dynamometer, a lift and an engine analyzer. A diagnostic inspection (98 items) is $20.88.
- Montgomery Ward. The Montgomery Ward diagnostic lane is part of an 18-bay automotive service facility in Falls Church, Virginia. The lane is equipped with a Sun 2001 engine analyzer, a combination brake/chassis dynamometer and a scuff gauge, and inspects approximately five vehicles per day. A diagnostic inspection of approximately 100 items is $18.95.
- United Systems Testing. This mobile van inspection and repair business was operated from July, 1978 to December, 1979 in St. Louis, Missouri. A GMC transmode van was used to transport diagnostic testing equipment to company parking lots, fleets, leasing companies and individual's homes. A full inspection was available for $35.00 in 1979.

FACILITY LAYOUT AND ARCHITECTURAL CONSIDERATIONS

A summary of the facility layout and other architectural aspects of the ten commercial diagnostic facilties is presented in the following sections:

- Facility Layout and Size
- Safety Accommodations
- Noise Reduction and Ventilation.

Facility Size and Layout

The ten commercial diagnostic facilities encompass a diverse group of operating layouts and architectural designs. They include both lane and open work area layouts and one mobile van. Among the seven facilities which operate diagnostic lanes, one, Automotive Evaluation Center, has located the diagnostic lane in a building separate from the repair bays. All of the lanes include customer viewing areas. The two non-lane facilities perform all diagnostic and repair work in the same open workspace. Further details of the facility layouts and size are presented below.

Diagnostic Facility Layout

Seven of the ten commercial diagnostic facilities have diagnostic lanes capable of moderate to high throughput. The lanes are equipped with diagnostic test equipment, occasionally a lift and in two cases an inspection pit (Auto Lab, Imperial Esso).

Two of the facilities have open warehouse facilities in which cars are diagnosed and repaired. These facilities, Automotive Performance Specialists and Avocation Ltd., are not segmented into conventional service bays but have large open areas sufficient to accommodate five and six cars respectively.

The mobile facility, United Systems Testing, was operated out of a 26 foot General Motors Corporation Transmode steel shelled motor van. For testing, the diagnostic equipment was moved out of the van via a ramp and cars were tested alongside the motor van. Table III-1 identifies the facilities with diagnostic lanes, those with open work space and the mobile van.

Diagnostic Facility Size

Table III-2 summarizes the dimensions of the commercial diagnostic facilities. The diagnostic lanes operated by the commercial facilities range in size from a small 630 square foot (18' x 35') lane at J.C. Penneys in Wilmington, Delaware to a large 2,000 square feet (20' x 100') lane at Auto Lab in Mt. Clair, California. Each of the lanes is operated in conjunction with four to 18 repair bays. The average number of bays for the facilities with diagnostic lanes is 12.7; thus the typical commercial diagnostic facility has a relatively large volume repair business. Assuming that an average bay contains 420 square feet (12' x 35') and an average lane has 1,253 square feet (18.7' x 67'), a facility with 12 repair bays and 1 diagnostic lane would have a ratio of repair to diagnostic space of 4:1 excluding all office, customer and other auxiliary areas. The estimated ratio of repair to diagnostic space is 9:1 at the J.C. Penneys facility (18 repair bays) and 4.2:1 at the Imperial Esso facility (12 repair bays).

TABLE III-1. COMMERCIAL AUTO FACILITY LAYOUTS

Type of Layout	Diagnostic Facility Location
Mobile Van	United Systems Testing St. Louis, Missouri
Lane	Auto Lab Mt. Clair, California
Lane	Automotive Evaluation Center Long Beach, California
Lane	Call Carl Washington, D.C.
Lane	CARDOC La Mesa, California
Lane	Imperial Esso Toronto, Canada
Lane	J.C. Penney Wilmington, Delaware
Lane	Montgomery Ward Falls Church, Virginia
Open Work Area	Automotive Performance Specialist Newington, Virginia
Open Work Area	Avocation , Ltd. Merrifield, Virginia

TABLE III-2. SIZE OF COMMERCIAL DIAGNOSTIC FACILITIES

Commercial Diagnostic Facility	Number of Diagnostic Lanes	Lane Dimensions (Feet)	Number of Repair Bays	Ratio of Repair to Diagnostic Space*
Auto Lab	1	20 x 100	7	1.5:1
Automotive Evaluation Center	1	18 x 35	14	9:1
Automotive Performance Specialists	-	-	5	**
Avocation Ltd.	-	-	6	**
Call Carl	1	18 x 75	4	1:1
J.C. Penney	1	16 x 52	18	9:1
CARDOC	1	21 x 72	16	4:1
Imperial Esso	1	20 x 60	12	4:1
Montgomery Ward	1	18 x 75	18	6:1
United Systems Testing ***				
Average Diagnostic Lane Dimensions		18.7 x 67		
Average number of Bays in Facilities Having a Diagnostic Lane			12.7	
Average Ratio of Repair to Diagnostic Lane Space				5:1

* Assumes a bay size of 420 square feet (12 x 35) and excludes all office, customer and other auxiliary space

** Repair and diagnostic functions performed in same area

*** Mobile van.

Safety Accommodations

Commercial diagnostic facilities are characterized by the same general safety accommodations as a conventional repair facility or private garage. These safety accommodations include the provision of fire extinguishers in the work area and safety goggles or ear protection when necessary. Additional safety accommodations which can be found in the diagnostic facilities include the following:

- Warning signs to keep motorists away from the inspection and other work areas
- Requirements for male workers not to wear long ties which may get caught in the testing machinery
- Painting the floor with stripes and other markings to indicate unsafe areas
- Providing curbs on either side of the diagnostic lane for control of the vehicle's total travel path.

No further safety precautions were identified by the facility spokesmen.

Noise Reduction and Ventilation

Elaborate noise reduction or ventilation provisions are not typical of the commercial diagnostic facilties which were examined. Accommodations which are made to reduce noise include providing a glass enclosed waiting area for customers and installing noise reducing tiles in the ceiling. Techniques used to improve ventilation include:

- Keeping the lane and bay doors open during the Summer.
- Attaching vehicles to metal or rubber exhaust ventilation systems. (One such system installed at the Avocation Ltd. facility exhausts 1200 cubic feet of air per minute via 70 foot rubber exhaust hoses extended from the ceiling).
- Use of ceiling and floor fans to keep the air circulating.
- Use of exhaust ducts near inspection pits and dynamometers. (The exhaust system installed at the Imperial Esso facility has two ducts in front of the pit and two in front of the dynamometer).

EQUIPMENT

Equipment used in the commercial diagnostic inspection facilities is described in the following sections:

- Test Equipment
- Data Processing Equipment

Test Equipment

The same types of major diagnostic test equipment are used in the commercial diagnostic inspection facilities as in the auto club diagnostic facilities. These major types of equipment include the following:

- Engine analyzers
- Emission analyzers
- Chassis dynamometers or combination chassis dynamometers/brake analyzers
- Alignment testers (including both scuff gauges and dynamic alignment machines)
- Headlamp aim testers.

Each type of equipment was found in approximately the same proportion of the commercial diagnostic as the auto club facilities. For example, engine analyzers were found in 100 percent of the commercial and auto club facilities, emission analyzers were found in 60 percent of the commercial facilities and 57 percent of the auto clubs, and chassis dynamometers or combination chassis dynamometers/brake analyzers were found in 70 percent of the commercial facilties and 71 percent of the auto clubs.

Table III-3 identifies the number of units of major testing equipment at each commercial diagnostic inspection facility. Most of the facilities have three, four or five major units of equipment. The former owner of CARDOC reported that his facility had ten major units of equipment, but this may have included some equipment that was used exclusively for repairs. The inspection facility with the least equipment was the mobile van of United Systems Testing, which was equipped with a Sun 1115 engine analyzer.

Auxiliary equipment found in the commercial diagnostic facilities includes a broad selection of specialized testers. The principal auxiliary equipment is as follows:

- Alternator/voltage regulator
- Voltmeter
- Battery charger

TABLE III-3. MAJOR TEST EQUIPMENT USED IN COMMERCIAL DIAGNOSTIC INSPECTION FACILITIES

Commercial Diagnostic Facility	NUMBER OF UNITS																																	Total Units
	Engine Analyzers											Emission Analyzers					Brake Analyzers/ Dynamometers						Alignment Testers								Headlamp Testers			
	Sun 947	Sun 1015	Sun 1020	Sun 1115	Sun 1220	Sun 2001	Autoscan 4030R	Marquette	Allen	Clayton	Snap-On Performance Analyzer	Sun EPA-75	Snap-On MT-665	Marquette	Beckman	Clayton 10-30	Clayton Chassis, Dyno/Brake Analyzer Combination	Clayton Chassis Dynamometer	Clayton Brake Analyzer	Curtis-Wright Brake/Chassis Dyna.	Marquette Brake/Chassis Dyna.	Maxwell Dyna./Brake Tester	Clayton Scuff Gauge	Bear Scuff Gauge	Bear Dynamic Alignment Machine	Maxwell Scuff Gauge	Snap-On Alignment Rack	Hunter (Merrill) Alignment Machine	Weaver Scuff Gauge	Bear Magnetic (Caster/Camber) Gauge	Weaver Headlight Tester	John Beam Headlight Tester	Bear Headlight Tester	
Auto Lab								1						1			1						1		1									5
Automotive Evaluation Center							1									1	1												1	1	1			6
Automotive Performance Specialists											1		1														1					1		4
Avocation, Ltd.	1			1		1						1																						4
Call Carl									1								1											1						3
Cardoc			1		1					1					1			3	1									1			1			10
Imperial Esso								1	1					1						1											1			5
J.C. Penny's				1										1							1				1								1	5
Montgomery Ward						1																1				1								3
United Systems Testing				1																														1

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- Starting/Charging System Tester
- Cylinder Leakage Tester
- Fuel Injection Manometer
- Fuel Pump Tester
- Distributor Tester
- Hydraulic Press
- Generator Tester.*

Data Processing Equipment

Eight of the ten commercial diagnostic facilities perform all data handling functions manually. A data collection form is used by the inspectors to notate the condition of the individual vehicle components, and a copy is given to the motorist following the inspection.

Two of the facilities, Call Carl in Washington, D.C. and J.C. Penney's in Wilmington, Delaware, use limited automated data collection procedures. Both diagnostic facilities are equipped with small pendant data input terminals suspended from the ceiling in the diagnostic lane. The data entered by the inspector is automatically printed out at a typewriter located in the customer waiting area.

Call Carl uses a Rontel Computer/printer #33 teletype unit. J.C. Penney's prints the results using an IBM typewriter. Both units of equipment are located in the customer waiting area of the respective facilities and test results can be read by the customers as the inspection progresses.** The inspection data is printed only on the hard-copy inspection form and is not collected by any electronic medium.

FACILITY STAFFING/TRAINING PROVISIONS

This section summarizes the staffing levels of the commercial diagnostic facilities, their inspector employment requirements and training opportunities.

Staffing Levels

Table III-4 summarizes the staffing levels for the commercial diagnostic inspection facilities. As much as possible the number of positions is limited to those directly involved in the diagnostic process. However, in many cases separating the diagnostic from the repair staff is not feasible since the

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* Other auxiliary equipment includes tachometers, dwellmeters, compression gauges and tire pressure gauges.

** Information on test results is typically limited to an indication of pass, fail or marginal condition for each component.

TABLE III-4. COMMERCIAL DIAGNOSTIC FACILITY STAFFING LEVELS

Commercial Diagnostic Inspection Facility	Station Management	Inspector Supervisers	Senior Inspector/ Mechanic	Junior Inspector/ Mechanic	Counselor/ Diagnostician	Aides/ Clerical Staff	Total
Auto Lab	1	-	2	-	1.5	-	4.5
Automotive Evaluation Center	2	-	5	-	1	3	11
Automotive Performance Specialists	1	-	-	2	-	1	4
Avocation Ltd	1	1	3	1	-	1	7
Call Carl	1	1	-	-	1	1	4
CARDOC	1	-	1	-	4	2	8
Imperial Esso	2	-	-	-	1	1	4
J.C. Penny's	1	-	-	-	1	-	2
Montgomery Wards	2	-	2	-	2	-	5
United System Testing	1	-	2	-	2	-	5
Average for All Facilities	1.3	0.2	1.5	0.3	1.35	0.9	5.45

personnel perform both functions. This is particularly true of the facility management and clerical positions, and at Automotive Performance Specialists and Avocation Ltd. all the mechanics perform both diagnoses and repairs. Four-of-the-ten commercial facilities have either four or four and one half (one part-time) staff members, typically including a facility manager, a senior inspector or mechanic, a counselor/diagnostician and one clerical assistant.

Inspector Employment Requirements

Commercial diagnostic facilities have generally not established stringent employment requirements for inspectors. When asked about inspector employment requirements, several of the facility managers responded either by saying that there were no specific employment requirements or by describing the background of the currently employed diagnostician. Just two facilities (Auto Lab in Mt. Clair, California and Imperial Esso in Toronto, Canada) require inspectors to be licensed mechanics.

Call Carl and J.C. Penney's each have one diagnostician who has served in this capacity for eight and ten years respectively. They were not hired as diagnostic inspectors but were transferred into this position when the lanes were opened.

The two California diagnostic facilities, Auto Lab and Automotive Evaluation Center, require inspectors to have California Class "A" (smog) inspection licenses. Montgomery Wards in Virginia also requires its single diagnostician to have a State inspection certificate. NIASE certification in at least one area is also encouraged by Montgomery Wards.

Several of the facility managers stated that a strong background in automotive repair is not required for employment. CARDOC, when it was operating, utilized retired Navy chiefs and Marine master sergeants who were trained on the job as diagnosticians. Automotive Performance Specialists in Newington, Virginia, also claims to hire and train low skilled people as inspectors.

In summary, the commercial diagnostic inspection facilities do not have very strict employment requirements for inspectors. These requirements may include some automotive employment or training background, a state inspection license, and possibly some certification from NIASE.

Inspector Training Provisions

Two of the facilities, Auto Lab and Avocation, Ltd., operate inspector/mechanic training schools on the facility premises. Auto Lab's training program emphasizes California

[redacted]

State inspection and smog licensing tests, and graduates approximately 100 students per year. Avocation, Ltd. operates an "Automotive Academy" which includes courses on automotive testing and diagnosis, emissions control operation and service, oscilloscope analysis, basic electrical systems and air conditioning. The 32-hour automotive testing and diagnosis course costs $155.00 (1980 dollars) and includes practical hands-on experience as well as classroom studies on the following topics:

- Compression
- Ignition
- Fuel emission control
- Starting and charging.

Of the other commercial diagnostic facilities, the programs operated by two mass merchandisers and an oil company provide more structured training opportunities than the small independents. J.C. Penney's, Montgomery Ward and Imperial Esso provide the following training opportunities for their inspectors:

- J.C. Penneys. The J.C. Penney Company operates an automotive training center in Atlanta, Georgia where attendance at technical courses by mechanics and inspectors is sponsored by the company.

- Montgomery Ward. The Montgomery Ward facilty in Falls Church, Virginia requires its diagnostic inspectors to attend a local week-long diagnostics seminar taught by Avocation Ltd. The company also sponsors attendance by its employees at the GM training center in Fairfax, Virginia, and at training sessions conducted by the test equipment manufacturers.

- Imperial Esso. Imperial Esso operates an automotive training program for its employees, with attendance sponsored by the company. The company also sponsors attendance at up to six regional new car conferences per year per employee.

Training provisions offered by the small diagnostic facilities include on-the-job training, manufacturers' bulletins and other literature, and occasional test equipment manufacturers' seminars. Two of the facilities responded that no training provisions are offered.

CUSTOMER COUNSELING AND OTHER SERVICES

Customer services are more limited at the commercial diagnostic facilities compared with the auto clubs. The commercial facilities have not assumed the role of consumer automotive educator; thus the services that are provided are strictly those paid for by the customer. These services are discussed below in the following sections:

- Pre-Inspection Interview
- Post-Inspection Counseling
- Repair Facility Recommendations
- Other Customer Services.

Pre-Inspection Interview

All of the commercial facilities studied utilize a conventional approach to counseling; a diagnostic checklist is completed by the inspector and is then verbally reviewed with the customer. Only one facility, Avocation Ltd., collects a vehicle history before the inspection. This history includes documentation of current problems being experienced with the car and a recent repair history. A copy of the vehicle history is maintained on file at the facility.

Post-Inspection Counseling

A diagnostic checklist is used by all of the facilities to rate the condition of vehicle parameters and components. Montgomery Ward rates items either standard, substandard or critical, while Automotive Performance Specialists rates them good, needs adjustment, or needs repair. In all facilities a copy of the inspection results is provided to the customer following the inspection. In a few facilities a copy of the Sun 2001 engine analysis printout is also provided to the customer.

Counseling sessions are estimated by the facility managers to last an average of 10 to 15 minutes. All of the facilities except United Systems Testing (U.S.T.), offer counseling as a standard procedure. At U.S.T. customer consultations were available on request. The purpose of the counseling sessions is to review the inspection results and point out needed repairs. Estimates of repair costs are always provided by six of the ten facilities and are provided on request by the other four.

Repair Facility Recommendations

The Automotive Evaluation Center, sensitive to its potential conflict of interest in operating both a diagnostic lane and a repair shop, has attempted to raise the customer's confidence by limiting the types of repairs it performs, as well as locating the lane away from the repair bays. The Center performs repairs only on brakes and the front end, and will also perform tune-ups. For other necessary work, the Center diagnosticians will advise the customer on selection of an appropriate type of repair facility.

Avocation Ltd. purposely limits the majority of its repair work to engine troubleshooting, repairs and tune-ups. The owner is seeking to build a high technology image for his facility. For all other work, the facility's senior mechanics will advise customers on the selection of an appropriate type of repair facility. Specific facility recommendations are not made.

Additional Customer Services

No free mechanical adjustments were mentioned by the commercial diagnostic inspection facilities, with one exception. The diagnostician at J.C. Penney's lane reported that he will correct the adjustment of the idle fuel mixture screw while the car is being tested on the engine analyzer. Other customer services offered by the commercial facilities include the following:

- The United Systems Testing van was available for diagnostic testing and repairs at the customer's residence or workplace, and according to a very flexible schedule.
- Avocation Ltd. will prepare a typed analysis of a vehicle's condition for a fee of $5.00 for individual motorists, and $15.00 for fleet owners. The owner of Avocation Ltd. will provide expert testimony in litigation involving automobiles that he has diagnosed.
- Other facilities provide window partitioned viewing areas for the customers, magazines, television and complimentary coffee.
- All of the facilities also offer repair services at their own labor rate, plus parts.

VEHICLE PROCESSING CAPABILITY

The commercial diagnostic facilities typically perform a more limited inspection than the auto clubs, but on the average they inspect the same number of vehicles per day per inspector (five). In addition, the average number of vehicles inspected per day at a commercial facility (9.3) is less than half the average of the specialized auto club diagnostic facilities

(26). This difference in workload implies that the commercial facilities emphasize repair over their diagnostic services. Further details of vehicle process times and total throughput are presented below.

Average Processing Time per Vehicle

Table III-5 summarizes the average per vehicle process time for each of the facilities. Inspection times range from 30 to 99 minutes, with an average of 45 minutes per vehicle. Counseling time is generally estimated by the facility managers at 10 to 15 minutes. The total average vehicle process time for all facilities is 57 minutes per vehicle, including inspection and counseling. This is approximately 15 percent shorter than the average auto club vehicle process time of 67 minutes.

TABLE III-5. AVERAGE PROCESSING TIME PER VEHICLE

Commercial Diagnostic Facility	Average Processing Time per Vehicle		
	Inspection (Minutes)	Counseling (Minutes)	Total Process (Minutes)
Auto Lab	35	10	45
Automotive Evaluation Center	50	10	60
Automotive Performance Specialists	42	10	52
Avocation, Ltd.	60	15	75
Call Carl	48	10	58
CARDOC	45	15	60
Imperial Esso	30	15	45
J.C. Penney	61	10-15	71-76
Montgomery Ward	45	15	60
United System Testing	40	5	45
Average for all Facilities	45	12	57

Average Vehicle Processing Capabilities

Table III-6 presents the average number of vehicles processed by each of the diagnostic facilities. Most employ one or two diagnosticians, who handle from two to twelve inspections per day, with an overall average of five vehicles inspected per inspector per day, the same average rate as the auto club facilities. The commercial facility claiming the highest average throughput is CARDOC, which ceased operation in 1975, but which processed 32 cars per day with four diagnosticians while the facility was operating.

Three facilities reported an average vehicle throughput of two cars per inspector per day; Automotive Performance Specialist, J.C. Penney's and Avocation, Ltd. This comparatively low throughput is possibly explained by a limited demand for diagnostic inspection at Automotive Performance Specialist and J.C. Penney's. The Avocation Ltd. facility purposely schedules no more than four diagnostic inspections per day to free the engine analyzers for tune-ups and engine repair work.

COMMUNITY INTERACTION

The principal community-oriented involvement of the commercial diagnostic facilities is membership in local business, community and professional organizations. Memberships maintained by several of the facilties include the following:

- Better Business Bureau
- Chamber of Commerce
- National Automotive Dealers Association
- Automotive Service Council
- San Diego Employers Association
- Auto Club of Southern California
- Greater Washington Board of Trade
- United Way.

In addition to company business memberships, the manager of the Montgomery Wards store is on the Fairfax County Advisory Board for Distributive and Adult Vocational Education. The J.C. Penney's store at one time sponsored cooperative work study programs for students, but is no longer involved in that activity. Three of the facilities have no involvement in business or community activities.

TABLE III-6. AVERAGE VEHICLE PROCESSING CAPABILITIES

Commercial Diagnostic Inspection Facility	Average Number Inspectors/ Facility*	Average Number of Vehicles/ Day	Average Number of Vehicles/ Inspector/Day
Auto Lab	2	12	6
Automotive Evaluation Center	1.5**	10	7
Automotive Performance Specialists	1	2	2
Avocation, Ltd.	2	4	2
Call Carl	1	8	8
CARDOC	4	32	8
Imperial Esso	2	8	4
J.C. Penney	1	2	2
Montgomery Ward	1	5	5
United System Testing	2	10	5
Average for All Facilities	1.75	9	5

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* In the majority of the facilities the inspectors double as mechanics.

** One fulltime and one part-time diagnostic inspector.

QUALITY CONTROL

The predominant quality control technique utilized by the commercial diagnostic inspection facilities is to have the diagnostic work checked by a supervisor or the facility manager. The check may be made in response to questions by the diagnostician or the customer, or it may be performed as a standard procedure.

Other quality control procedures include equipment maintenance and calibration, independent quality reviews and replacement of inferior equipment. The application of these quality control procedures by the commercial facilities is addressed in the following sections.

Frequency of Equipment Maintenance

Table III-7 shows the frequency of test equipment maintenance as reported by the facility or diagnostic lane managers. The frequency of equipment maintenance for all of the facilities varies from monthly to semi-annually or as needed, with no single maintenance frequency more prevalent than another.

Four of the facilities perform equipment maintenance only when it is needed as evidenced by obviously inaccurate readings or equipment malfunctions. Three of the facilities, Call Carl, Imperial Esso and Automotive Evaluation Center, perform periodic maintenance on the dynamometers but not other test equipment. Avocation Ltd., on the other hand, performs maintenance every 90 days on its engine analyzers only.

Gas calibration of the emission analyzers also varies in frequency from bi-weekly to quarterly or as needed. The most frequent emission analyzer gas calibration is performed every two to three weeks by the Automotive Evaluation Center in Long Beach, California. Auto Lab in Mt. Clair, California, and Avocation Ltd. in Merrifield, Virginia, perform the calibration quarterly. Three facilities have no schedule for calibrating their emission analyzers.

Independent Quality Reviews

The Auto Club of Southern California provides an independent quality review service to its member diagnostic centers. An unidentified vehicle that has been previously inspected by AAA engineers is taken to the participating commercial diagnostic facility and diagnosed. The diagnostic test results are then compared with the AAA's own test results and an analysis is prepared for the facility manager. This quality control check is performed twice a year for each member

TABLE III-7. FREQUENCY OF EQUIPMENT MAINTENANCE

Maintenance Schedule / Diagnostic Facility	Scheduled Equipment Maintenance					Gas Calibration of Emission Analyzer				
	Monthly	Quarterly	Semi-Annually	According to Manufacturer's Specifications	As Needed	Bi-Weekly	Monthly	Quarterly	As Needed	Seldom
Auto Lab					X			X		
Automotive Evaluation Center			X[1]			X				
Automotive Performance Specialists					X				X	
Avocation, Ltd.		X[2]						X		
Call Carl[3]	X[1]									
Cardoc				X			X			
J.C. Penny's					X					X
Imperial Esso[3]		X[1]			X					
Montgomery Ward	X								X	
United Systems Testing	[2]				X		X			

1 Dynamometer only.
2 Engine analyzers only.
3 No emission analyzer.

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diagnostic facility and is entirely funded by the AAA. The Automotive Evaluation Center in Long Beach, Auto Lab in Mt. Clair and CARDOC, which operated in La Mesa, California, have participated in this independent quality review program.

Equipment Replacment

Two of the eight currently operating commercial diagnostic facilities are planning to replace equipment in the near future. Avocation, Ltd. will be installing a Clayton Chassis dynamometer to replace another dynamometer that was considered unsatisfactory. Call Carl plans to replace its Merrill dynamic alignment machine with a scuff gauge. The dynamic alignment machine was found to give inconsistent readings and has not been used in some time. Several of the other facilities either have relatively new equipment or simply have no plans to replace any units.

MEASURES OF EFFECTIVENESS

Measures of effectiveness for a commercial diagnostic inspection facility may include the following:

- A measure of reasonableness of the inspection fee
- A measure of acceptance of the inspection program by the public and the repair industry.

An analysis of each of these measures with regard to the diagnostic facilities is presented below.

Reasonableness of the Inspection Fee

Commercial diagnostic inspection fees are based on the estimated labor time required for the diagnosis, plus, in some cases, a small machine time charge. For example, Avocation Ltd. calculates its diagnostic inspection fee as follows:

Labor Time (1 Hour)	+	Machine Cost (Nominal)	=	Inspection Fee
$27.00		$1.50	=	$28.50.

Avocation Ltd. acknowledges that the $28.50 fee for a 75 minute inspection (including counseling) is not sufficient to operate the repair/inspection facility, pay all labor costs and make a reasonable profit. Thus, in the sense of reimbursing the owner for costs incurred, the inspection fee is not reasonable.

In a commercial diagnostic inspection facility, however, the diagnostic fee is considered a loss-leader which will draw repair work into the shop. This assumption is supported by the Montgomery Ward, J.C. Penney's and Call Carl spokesmen who all reported that at least 50 percent of inspection customers usually request that repair work be performed by the diagnosing facility. In some cases the estimates are as high as 75 percent. Therefore, by itself the inspection fee may not be reasonable, but combined with the additional repair work it may become sufficient to justify operating the diagnostic inspection service.

Table III-8 summarizes the estimated fee per minute for a diagnostic inspection at each of the commercial facilities operating in 1980. The average fee per minute for eight facilities is $.40. This fee is very reasonable from the consumer's viewpoint when compared with the $2.75 per minute fee for a high throughput emissions inspection in California ($11.00 fee for a four-minute inspection).

Public Acceptance of the Inspection

One way to evaluate public acceptance of the commercial diagnostic inspection facility is to consider the number of diagnostic inspections which have been performed by each facility. Table III-9 summarizes the estimated number of inspections performed per year at each facility and for all years of business to date. The average for all facilities is 1,785 inspections per year and 17,447 inspections over approximately nine years of business. On an individual basis, these numbers may suggest a degree of public acceptance of the diagnostic service.

[redacted]

TABLE III-8. COMMERCIAL DIAGNOSTIC INSPECTION FEES

Commercial Diagnostic Inspection Facility	Total Inspection Process Time[1] (Minutes)	Inspection Fee (1980 dollars)	Estimated Fee per Minute
Auto Lab	45	$24.95	$.55
Automotive Evaluation Center	60	21.00	.35
Automotive Performance Specialists	52	30.00	.57
Avocation, Ltd.	75	28.50	.38
Call Carl	58	21.95	.38
CARDOC[2]			
Imperial Esso	45	17.39[3]	.39
J.C. Penney	73	20.88	.28
Montgomery Ward	60	18.95	.32
United System Testing[4]			
Average for all Facilities	58.5	$22.95	$.40

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[1] All estimates provided by facilities

[2] CARDOC was closed in 1975 but at that time the fee was $12.95 for a 60-minute inspection

[3] Converted from $19.95 (Canadian dollars) to U.S. dollars.

[4] United System Testing closed in 1979 when the fee was $35.00 for a 45 minute inspection.

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TABLE III-9. TOTAL INSPECTIONS PERFORMED PER FACILITY THROUGH 1980

Commercial Diagnostic Inspection Facility	Year Diagnostic Lane Opened	Years of Business	Estimated Number of Inspections/Year*	Estimated Total Inspections Performed Through 1980
Auto Lab	1972	8	2,100	16,800
Automotive Evaluation Center	1966	14	1,750	24,500
Automotive Performance Specialists	1978	2	350	700
Avocation, Ltd.	1980	1	700	700
Call Carl	1965	15	1,400	21,000
CARDOC	1966-1975	9	5,600	50,400
Imperial Esso	1966	14	1,400	19,600
J.C. Penny's	1969	11	350	3,850
Montgomery Ward	1966	14	2,450	34,300
United System Testing	1978-1979	1.5	1,750	2,625
Average for All Facilities	1971	9	1,785	17,447

*Average number of inspections per year x 250 working days per year x 70 percent utilization factor.

IV. CHARACTERISTICS OF MOTOR VEHICLE DIAGNOSTIC INSPECTION DEMONSTRATION PROJECTS

Five motor vehicle diagnostic inspection demonstration projects were conducted by the National Highway Traffic Safety Administration under the provisions of Public Law 92-513, the Motor Vehicle Information and Cost Savings Act (Title III). The purpose of the demonstrations was to determine the consumer-oriented costs and benefits of diagnostic inspection. To this end the projects performed over 125,000 in-depth safety and emissions diagnostic inspections during a 15-month period from 1975 to 1976.

Unlike the other diagnostic inspection programs and facilities discussed in this report, the five federally funded diagnostic demonstration projects have been extensively documented. Two reports in particular address topics that are pertinent to the development of diagnostic inspection concepts. They are:

- "Motor Vehicle Diagnostic Inspection Demonstration Program," Prepared by the U.S. DOT, National Highway Traffic Safety Administration, October, 1977, Technical Report DOT HS-802 760.
- "Diagnostic Motor Vehicle Inspection Demonstration Projects, Program Engineering Support, Volume 10 - Appendix I, Efficiency of Facility Designs Employed" by AVCO Corporation, December, 1976, Project DOT-HS-5-01037.

These reports describe the facility layouts, testing equipment, vehicle processing capabilility, quality control techniques used and other characteristics of the five projects. Further analysis of the performance and effectiveness of the projects can also be found in the publications listed at the conclusion of this chapter. Appendix C of this report also presents a detailed summary of facilities at each of the five diagnostic demonstration projects. The locations of the facilities are as follows:

- Huntsville, Alabama
- Tucson, Arizona*
- Washington, D.C.
- San Juan, Puerto Rico**
- Chattanooga, Tennessee.

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* A single-lane demonstration project was also conducted at Phoenix.

** Other demonstration projects were located at Bayamon and Ponce.

Since the demonstration projects have been extensively documented, this chapter will present a summary of selected aspects of the projects which are significantly different from other types of diagnostic inspection facilities. The chapter is organized in the following sections:

- Utilization of Diagnostic Services
- Facility Layout
- Testing Equipment
- Incentives for Participants.
- Additional References

Utilization of Diagnostic Services

Unlike other diagnostic inspection facilities in which motorists seek out inspection services and pay a fee, the utilization of services at the diagnostic demonstration projects was free as well as voluntary. Thus, in order to obtain sufficient motorist participation to permit valid statistical analysis of the overall project results, the projects conducted public relations and media campaigns to attract participants.

Each participant was requested to have a participating vehicle inspected every six months, to have repairs made if the vehicle failed inspection and to return for a reinspection with the repair bill. It was also requested that the participants maintain, and turn in, records of repairs, maintenance and gas consumption between inspections. To permit comparison of the utility of the inspections and the information provided by the inspection to motorists, each project differentiated inspections and informational support for two groups: a treatment group that received a complete inspection and full diagnostic information, and a control group that received, depending on the project, a lesser inspection and/or a pass/fail report on the inspections of vehicle subsystems. Thus, analysis of diagnostic and repair data for the two groups was used to identify the consumer oriented benefits of diagnostic inspection.

Facility Layout

The Title III vehicle diagnostic inspection demonstration projects were intended to demonstrate a process of intensive vehicle inspection in a high throughput facility layout. All five of the projects organized their inspection process primarily in a lane configuration to meet this objective. Only Tennessee utilized bays as a part of the process flow. In that demonstration all inspections using a lift were conducted in a bay. The District of Columbia did not use bays at all; Puerto

Rico used a bay for incentive repairs; Alabama and Arizona used bay areas to conduct engine analysis for vehicles which failed the emissions inspection in the lane.

Typically, the demonstrations were conducted in one or two lanes of a modern or newly erected facility. In some cases (Tennessee and the District of Columbia), the demonstration projects shared facilities with the local PMVI programs. Approximately 8,100 square feet of 15,200 square feet within the Chattanoogo PMVI facility was used for the demonstration project. Approximately 2,900 square feet out of 17,800 square feet of the District of Columbia permanent inspection facility was used for the demonstration project. At the latter facility, participant waiting rooms and reception areas were accommodated by using a remote trailer on the facility lot.

Testing Equipment

There was some commonality in the types of major automated equipment and instrumentation used. Table IV-1 lists the equipment used for brake inspection, alignment, emissions and engine analysis and headlight aim. All the projects utilized:

- A dynamic wheel alignment tester providing caster, camber and toe information.
- Infra-red exhaust analyzers to determine exhaust gas emissions content.
- An engine analyzer.
- A roller brake tester. Tennessee and the District of Columbia used a platform brake tester, as well, to measure wheel braking balance and force. Tennessee also used a second roller brake tester to verify the integrity of the brakes after wheel pull.
- A chassis dynamometer was used for loaded emissions and engine analysis in all sites except Puerto Rico.
- An instrumented headlight aim tester.
- Twin or four-post lifts to raise the vehicle in order to inspect undercarriage subsystems and components and to remove the wheels to examine brake materials.

Incentives For Participants

The five projects offered incentives to motorists for participating in the demonstration projects. If needed, tires were properly inflated at some projects, and if easily

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TABLE IV-1. SUMMARY OF MAJOR TEST EQUIPMENT USED IN THE TITLE III DEMONSTRATION PROJECTS

	Alabama	Arizona	District of Columbia	Puerto Rico	Tennessee
Alignment	Wheel Alignment Tstr. (Hunter F-60)	Wheel Algn. Tstr. (Hunter F-60)	Wheel Algn. Tester (Hunter F-60) Auto. Wheel Algn. Indicator (Weaver WY-27)	Wheel Algn. Tester (Hunter F-60)	Wheel Algn. Tester (Hunter F-60) Caster-Camber Gauge (Bear 29) Optic. Algn. Gauge (Dunlop ACO/30) Auto. Wheel Algn. Tester (Weaver WJ-132A)
Wheel Bal.				Whl. Spinner-Electr. Indicator (Hunter 25-42-1)	
Brake Test	Brake Analyzer Clayton DB 8 CP	Brake Test Stand Hofman Brekon 1	Brake Tester Weaver WY-75 Brake Analyzer Clayton DB-8-CP	Dynamic Brake Analyzer Clayton DB-8-CP	Dynamic Brake Analyzer Clayton PB-CP-201-R Platform Type Brake Tester Bear 47-105 Highspeed Rotor Brake Tester Sun RAM-937
Dynamometer	Chassis Dynamometer Clayton C720/Key Mode SCT Diagn. Console Clayton CSS-7100	Chassis Dynamometer Clayton CT 200 Dynomometer Sun RAM937 or Clayton DB-8CP-200 Regulator Alt. Tstr. Sun VAT-28 Tune Up Tester Sun TUT-915R	Elect. Eng. Analyzer Clayton CSC 5102	Eng. Anal. Infra-red Exhaust Emission Analyzer Allen 18-200	Dynamometer Sun RAM-937 Engine Analyzer Marquette 40-225 Elec. Eng. Analyzer Clayton CSS 5101
Engine Analysis	Diagn. Console Clayton CSS/7100	Regulator/Alt. Tstr. Sun VAT-28 Tune Up Tester Sun TUT-915-R	Elect. Eng. Analyzer Clayton CSS-5102	Eng. Anal. Infra-red Exhaust Emission Analyzer Allen 18-200	Engine Analyzer Marquette 40-225 Elec. Eng. Analyzer Clayton CSS-5101
Exhaust Emission	HC/CO Analyzer Chryslet 1, Hlc, IV	Autosense Hamilton Tst. Systms. Exhaust Analyzer Beckman 590 Autosense Hamilton Tst. Systms.	Stewart-Warner Emission Analyzer	Eng. Anal. Infra-red Exhaust Emission Analyzer Allen 18-200	Autosense Hamilton Tst. Systms. Exhaust Analyzer Beckman 590 Infra-red Emis. Anal. Marquette 42-159 Emission Analyzer Horiba GSH-300A
Head-light	Headlight Tester Hunter HD Ray-O-Scope	Headlight Tester Bear 561	Headlight Tester Bear 561	Headlight Tester Bear 561	Headlight Tester Hunter 25-36-2

Source: Motor Vehicle Diagnostic Inspection Demonstration Program NHTSA; Department of Transportation, October 1977.

corrected, headlights were properly aimed. The Puerto Rico demonstration project provided a large number of incentive repairs as well. These included the following:

- Replacement of vehicle fluids, including battery, brake, windshield washer and power steering fluids
- Replacement of burned-out bulbs
- Wheel balancing
- Carburetor adjustments
- Brake adjustments.

Additional References on the Diagnostic Demonstration Project

The following reports and technical papers provide further documentation and analysis of the diagnostic inspection demonstration projects:

- University of Alabama in Huntsville, "Alabama Motor Vehicle Diagnostic Inspection Demonstration Project," Vols. I and II, Final Report, State of Alabama, prepared under Contract No. DOT-HS-5-01056, NHTSA, October, 1976.
- Arizona Department of Health Services, "Motor Vehicle Diagnostic Inspection Demonstration Project," Final Report, State of Arizona, prepared under Contract No. DOT-HS-5-01057, NHTSA, September, 1976.
- Department of Motor Vehicles, "Motor Vehicle Diagnostic Inspection Demonstration Project," Vols. I-III, Final Report, Government of the District of Columbia, prepared under Contract No. DOT-HS-5-01098, NHTSA, October, 1976.
- Department of Transportation and Public Works, "Automobile Diagnostic Inspection Program in Puerto Rico," Final Report, Commonwealth of Puerto Rico, prepared under Contract No. DOT-HS-5-01041, NHTSA, October, 1976.
- Wendell A. Cook, NHTSA, "Repair Industry Response to Diagnostic Inspection Projects," SAE Paper No. 780030, 1978.

- J.L. Duda, et al, "Program Evaluation Support for the Motor Vehicle Diagnostic Inspection Demonstration Program," Final Evaluation Report, Computer Sciences Corporation, prepared under Contract No. DOT-HS-5-01036, NHTSA, March, 1977.

- Kenneth P. Joncas, et al, "Diagnostic Motor Vehicle Inspection Demonstration Projects," Vols. I-XI, Program Engineering Support Final Report, AVCO Corporation, prepared under Contract No. DOT-HS-5-01037, NHTSA, December, 1976.

- B.J. Schroer and J.F. Peters, "An Evaluation of Vehicle Repair Costs for Auto Check Participants," Final Report, Center for Environmental and Energy Studies, University of Alabama, prepared under Contract No. DOT-HS-5-01056, February, 1977.

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V. CHARACTERISTICS OF A COOPERATIVE DIAGNOSTIC INSPECTION FACILITY

This chapter addresses cooperative car care centers in general and one cooperative car care center in particular, Co-op Auto, Inc., which is one of the few cooperatives that offers diagnostic inspection as a customer service. The principal advantage of cooperatives is that the users are also the owners of the center and they have some influence over the way that the center is operated. For this reason, users of cooperative car care centers may receive more personalized service than customers of commercial service facilities. This chapter is organized into two major sections:

- Overview of the Cooperative Concept
- Profile of Co-op Auto, Inc.

The first section will give a general overview of the cooperative concept and how it can be applied to automotive repair/diagnostic facilities. The second section provides a detailed description of Co-op Auto, Inc., which offers diagnostic inspection to its members. Appendix D contains a detailed inventory of the characteristics of Co-op Auto, as well as illustrations of the facility layout and data collection forms.

OVERVIEW OF THE COOPERATIVE CONCEPT

The concept of cooperatives in the U.S. was originally developed and refined by farm organizations as a collective venture to obtain better prices for commodities bought and sold by the members. With the advent of urbanization, the farm cooperatives expanded into units for merchandising non-agricultural consumer products as well. Many cooperatives now supply pharmaceutical products, furniture and car care services to their members and nonmembers.

Price discounts available through the cooperatives are based on their large volume buying power. Local cooperatives obtain their discounted prices by being part of a large cooperative network. Farm Union Central Exchange, for example, is an umbrella organization for 351 small automotive service centers (2 bays each), 248 car centers (3 bays each) and 96 complete car centers (4 or more bays). It operates in the States of Idaho, Minnesota, North Dakota, South Dakota, Washington, Wisconsin and Wyoming. Farmland Industry, based in Kansas City, has approximately 175 cooperative accounts for car care centers in 16 States.

Except for ownership, the cooperative car care centers are much like other repair facilities. Services offered by the cooperatives include the sale of gasoline, tires and batteries and a range of repair services including tune-ups, brakes, muffler and exhaust repairs and front end alignment. The primary activity for most cooperatives is auto repair. The Co-op Auto, Inc. of Ann Arbor is different from many other cooperatives in that it offers a number of consumer-oriented services as well as diagnostic inspection.

PROFILE OF CO-OP AUTO, INC.

Cooperative Auto of Washtenau, Inc. (Co-op Auto) is a non-profit cooperative established in Ann Arbor, Michigan. While its facility is open to the general public, it is primarily intended as a supportive inspection and repair facility for its membership. Services offered for a fee at the Co-op in addition to conventional repair activities, include the following:

- Diagnostic inspection
- Automotive education classes
- Self-repair facilities where space and rental equipment are available
- NIASE certified mechanics.

The following sections describe the layout, equipment, staffing and services of the Co-op.

Facility Layout and Architectural Considerations

Co-op Auto, Inc. is housed in a 4,800 square foot rectangular building on a 2-acre tract of land. The facility consists of a service shop with 10 bays, a parts storage area, an office and a customer waiting area. The service shop where inspections and repairs are performed covers an area of 3,600 square feet.

Conventional automotive shop safety practices are followed and ear protection is occasionally used by the mechanics. No structural accommodation has been made to reduce noise. Auto exhaust is removed from the facility via flexible hoses routed under the floor.

Equipment

The Co-op Auto facility has a modest inventory of test equipment which includes the following:

- Sun 747 engine analyzer
- Sun 915 engine analyzer
- Sun infrared emission analyzer
- Delco headlight aimer
- Sun VAT-40 and VAT-28 electrical system testers
- Bosch fuel injection pressure tester
- Distributor tester.

No data processing equipment is used in the facility. All forms are processed manually.

Facility Staffing/Training Provisions

Co-op Auto is staffed with a facility director, station manager, repair shop foreman, ten senior mechanics with at least one NIASE certification and two apprentice mechanics. The support staff includes one secretary/clerk, one driver and two parts department clerks. The senior mechanics are specialized according to different major auto manufacturers, i.e., General Motors, Chrysler, Toyota, etc.

No employee training provisions have been implemented beyond the supervision of the apprentice mechanics by the senior staff members. The apprentice mechanics can also attend the consumer education courses provided by the Co-op.

Customer Counseling and Other Services

Customer services in addition to repairs at Co-op Auto include counseling following a diagnostic inspection, self-repair facilities and consumer automotive classes. Each service is described below.

- Diagnostic Counseling. A diagnostic inspection checklist is completed during the inspection and is then reviewed with the customer. Customer consultations may last from 10 to 20 minutes. Co-op members are also provided with forms for recording maintenance procedures, and a vehicle history file for each vehicle is maintained at the Co-op. The Co-op will perform repairs for a $20.00 to $25.00/hour retail labor rate plus parts.

- Self-Repair Facilities. Weekend stall and tool rentals are available to Co-op members. Stall rental is $4.00 to $5.00 per hour plus a $10.00/year membership in the U-Do-It Club. Tool rentals are $8.00/hour for a portable analyzer with scope, $2.00/wheel for a spin balancer, $2.00 for a set of dwell and timing gauges and so on. Tutoring by the NIASE certified mechanics is also available to the self-repairers.

- Consumer Education Courses. Basic instructional courses in automotive physics and self-service maintenance are offered weekly to the public.

Vehicle Processing Capability

The vehicle processing capability of Co-op Auto is approximately the same as that of a commercial repair facility with an equivalent number of bays, lifts and certified mechanics. Approximately 60 minutes is required for a vehicle diagnostic inspection plus another 10 to 20 minutes for counseling. Theoretically the facility could perform seven to eight full diagnostic inspections per hour if no other work were performed. According to the facility director, approximately ten vehicles per day per bay are processed through the center, including all inspection and repair work.

Community Interaction

The two services which Co-op Auto provides to the community are as follows:

- The Co-op itself, which is owned, financed and operated as a membership cooperative. Services include self-repair facilities and membership discounts on most services.

- Consumer automotive courses in auto maintenance and repair.

Quality Control Techniques

Quality control during diagnostic inspections is primarily provided through supervision of the mechanics' work by the facility foreman or service manager. Equipment maintenance and calibration is performed at least twice a year by a visiting manufacturer's representative. The equipment is also repaired when it has an obvious malfunction. The Co-op plans to upgrade a portable engine analyzer with scope sometime during the 1980-81 timeframe.

Measures of Effectiveness

Co-op Auto depends on an annual membership survey to determine how effectively it is serving its members. The questionnaire asks members to identify any specific complaints and to suggest ways to improve services. Suggested new repair services are proposed in the questionnaire and the members are asked to state their interest in those services. Generally about 200 questionnaires are returned to the Co-op from each survey.

VI. CHARACTERISTICS OF FOREIGN AUTO CLUB DIAGNOSTIC INSECTION FACILITIES

This chapter presents a summary of diagnostic inspection services offered by auto clubs in five overseas countries: Australia, Austria, Germany, the Netherlands and New Zealand. Providing diagnostic inspection services is a more significant and widespread activity among the auto clubs in these five countries than in the U.S. As shown in Table VI-1 the number of diagnostic facilities in any one of the five foreign countries is more than three times the number of facilities in the United States. The Austrian auto club, ANWB, operates 89 diagnostic inspection facilities and the German ADAC operates 78 mobile diagnostic tractor trailors. Even the small countries of New Zealand and the Netherlands have 26 and 25 diagnostic facilities respectively, compared with a total of eight in the United States.

Broad generalizations about the availability of diagnostic inspection services in Europe compared with the United States cannot be made based on the programs above, however. Many other European auto clubs offer no diagnostic inspection services at all, including the clubs in Belgium, France, Italy, Switzerland, Spain, Sweden, Finland, Norway and Denmark. The British Automobile Association operates a single diagnostic facility in Hampshire, England, but the club is losing money on the operation and is considering closing the facility. Thus, the European and Australasian auto clubs are not uniform in their support of diagnostic inspection; Austria, Germany, the Netherlands, Australia and New Zealand are the strongholds of diagnostic inspection services.

The following sections provide an overview of the diagnostic inspection facilities in each of these five countries:

- Australia
- Austria
- Germany
- Netherlands
- New Zealand.

TABLE VI-1. TOTAL NUMBER OF DIAGNOSTIC INSPECTION FACILITIES IN SIX COUNTRIES

U.S.[1]	Australia[2]	Austria[3]	Germany[4]	Netherlands[5]	New Zealand[6]
8	44	89	78	25	26

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[1] U.S. facilities include permanent stations at St. Louis, Kansas City, Philadelphia, San Francisco and San Jose, and mobile stations at Baltimore (1) and San Francisco (2).

[2] Australian facilities include 13 operated by the NRMA, 11 operated by the RACQ and an estimated 20 facilities operated by the five other constituent clubs of the Australian Automobile Association.

[3] Austrian facilities include 86 permanent inspection centers and 3 mobile tractor trailer units.

[4] German facilities include 78 mobile tractor trailor units operated by ADAC.

[5] Stationary Dutch facilities operated by the ANWB.

[6] New Zealand stationary facilities operated by the 15 constituent associations of the New Zealand Automobile Association.

Examples of the diagnostic inspection checklists used in each country (translated to English) are presented in Appendix E.

AUSTRALIA

The Australian Automobile Association consists of seven constituent clubs, each of which has some independence in its operations. Two of the clubs which offer the most comprehensive inspection and diagnostic programs are the National Roads and Motorists Association (NRMA) located in the Sydney metropolitan area, and the Royal Automobile Club of Queensland (RACQ) headquartered in Brisbane.

The NRMA and RACQ have 13 and 11 diagnostic inspection centers respectively. The facilities typically have three lanes plus auxiliary office space, with a total of 1,000 to 1,500 square feet of building space. An alternative layout, which is found at the RACQ facility in Aspley, Australia, is illustrated in Figure VI-1. In this facility vehicles are routed through one of three flow-through bays where checks of the underbody, brakes, tires and engine performance are conducted. The traffic from all three bays is then routed into a fourth bay containing a speedometer tester and a wheel alignment machine. The vehicles are then road tested and returned briefly to the working areas of the bays for an exhaust smoke check.

Within the ten diagnostic inspection facilities in the Sydney metropolitan area, approximately 1,200 inspections per week are performed, with 50 percent of them performed on site.* The average diagnostic inspection time at an NRMA or RACQ facility is 90 minutes.

Additional characteristics of the Australian auto club diagnostic facilities are as follows:

- Equipment. Most of the NRMA and RACQ facilities are equipped with chassis dynamometers. Additional equipment found in the majority of facilities includes oscilloscopes, wheel alignment testers, wheel balancers, shock absorber testers and headlight testers. The makes of equipment are varied but Suntester, Blackhawk and Hofmann are predominant.

- Types of Inspection Services. Types of inspection services provided by the diagnostic facilities include:**

  - Autospec. A comprehensive examination of used cars prior to purchase, or of any new or used car prior to lengthy travel.

  - Newspec. A 170-item check on new cars prior to customer acceptance. The inspection emphasizes the manufacturer's quality standards and the dealer's pre-delivery servicing and preparation.

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* On-site inspections are performed at automobile dealerships, used car sales lots or other locations requested by members. These inspections do not include all of the same procedures as those performed in the diagnostic facilities.

** Selected diagnostic inspection checklists are provided in Appendix E.

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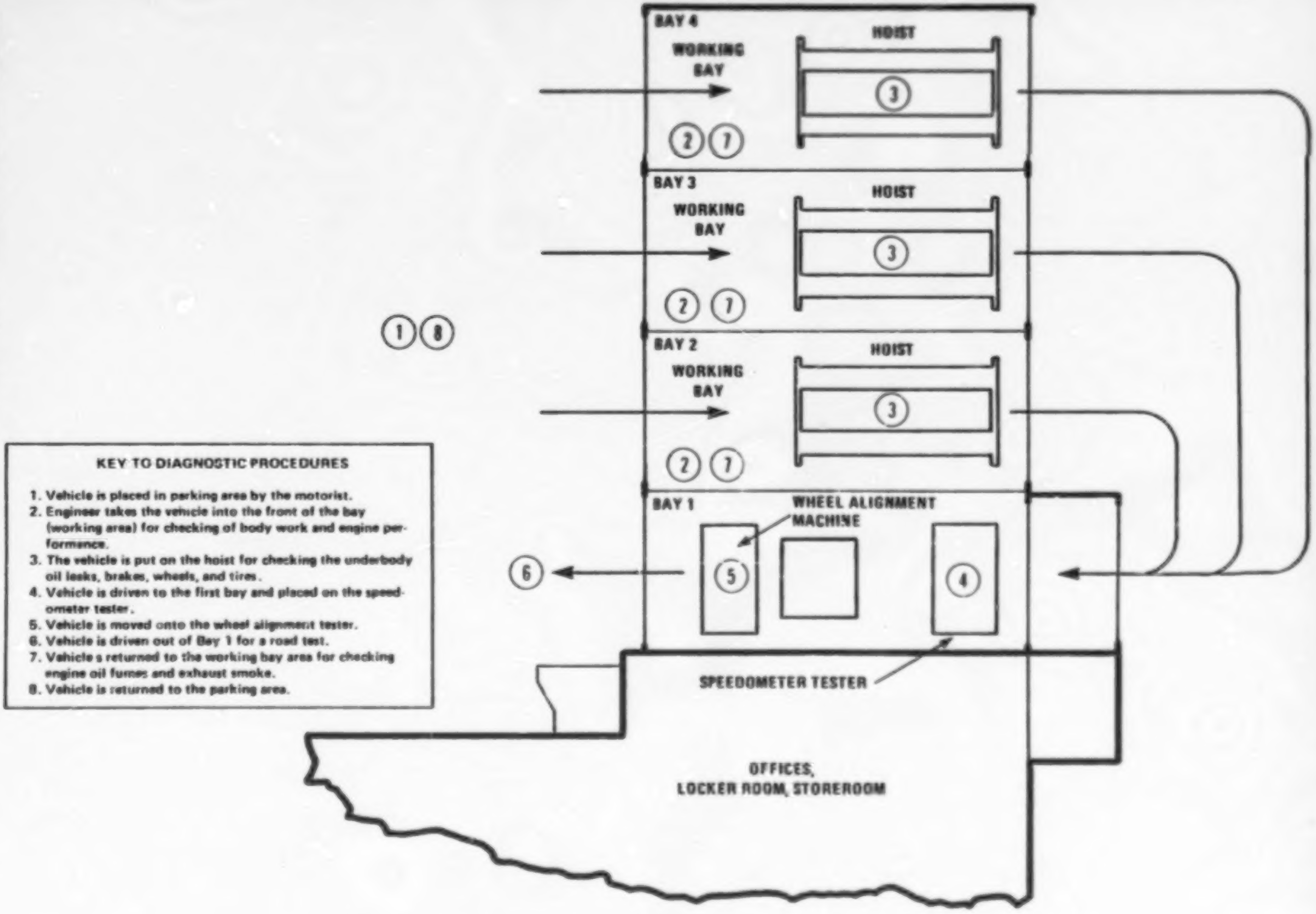
BAY 4
WORKING BAY
HOIST
BAY 3
WORKING BAY
HOIST
BAY 2
WORKING BAY
HOIST
BAY 1
WHEEL ALIGNMENT MACHINE
SPEEDOMETER TESTER
OFFICES, LOCKER ROOM, STOREROOM
①⑧
②⑦
③
④
⑤
⑥

KEY TO DIAGNOSTIC PROCEDURES

1. Vehicle is placed in parking area by the motorist.
2. Engineer takes the vehicle into the front of the bay (working area) for checking of body work and engine performance.
3. The vehicle is put on the hoist for checking the underbody oil leaks, brakes, wheels, and tires.
4. Vehicle is driven to the first bay and placed on the speedometer tester.
5. Vehicle is moved onto the wheel alignment tester.
6. Vehicle is driven out of Bay 1 for a road test.
7. Vehicle s returned to the working bay area for checking engine oil fumes and exhaust smoke.
8. Vehicle is returned to the parking area.

FIGURE VI-1. DIAGNOSTIC FACILITY LAYOUT FOR THE ROYAL AUTOMOBILE CLUB OF QUEENSLAND AT ASPLEY

- Warspec. A general overall inspection of new cars to check for any vehicle defects prior to expiration of the manufacturer's warranty period.

- System Inspections. Separate inspections can be performed for discrete vehicle systems including electronic engine diagnosis, engine and cooling system check, front suspension and steering inspection and brake inspection.

- Inspector Experience Requirements. NRMA inspectors are required to be certified motor mechanics with sufficient qualifications to gain membership in the International Association of Mechanical Engineers. Inspectors are required to be at least 25 years old, to have an Automotive Engineer's Certificate, and some supervisory experience. Continuous training is provided at the diagnostic facilities to augment the engineers' knowledge of new model vehicles, changes in inspection procedures, and technology innovations.

AUSTRIA

The Osterreichischer Automobil-, Motorad-und Touring Club (OAMTC) consists of seven regional clubs serving 700,000 members throughout Austria. The club has 89 diagnostic inspection facilities which also serve as bases for emergency road service. The largest diagnostic facility, located in Vienna, serves as the national headquarters for technical services.

Diagnostic inspections are performed on standard passenger cars with gasoline or diesel engines, motorcycles and small trailers. All of the facilities are open from 7:00 a.m. to 7:00 p.m. Government mandated safety inspections are performed, as well as comprehensive and pre-purchase inspections. All the facilities combined perform 578,000 technical inspections per year.

Further details of the inspection services, facility layouts, and equipment for the Austrian facilities are presented below:

- Types of Inspection Services. National uniformity of inspection services is emphasized by the OAMTC; thus a full range of inspection and diagnostic services is offered through all of the facilities. The types of inspection services offered include the following:

  - Government Inspection. This compulsory safety inspection includes an examination of 44 vehicle components and parameters. The approximate time required for the inspection is 20 minutes.

- Comprehensive Inspection. The comprehensive vehicle inspection includes an electronic engine analysis and compression test, a battery and generator/alternator test, inspections of the chassis, wheel alignment, headlamps, shock absorbers and brake fluid, and dynamic brake inspection and a road test. The comprehensive inspection takes approximately 45 to 60 minutes.

- Pre-Purchase Inspection. The pre-purchase inspection assesses the condition of the car and provides an indication of the extent of necessary repairs. The components and parameters inspected are similar to those of the comprehensive inspection.

- Facility Layout. The Austrian auto club, in trying to maximize the availability of diagnostic services to its members throughout the country, has provided numerous outlying stations and satellite diagnostic facilities. Many of these facilities are small compared with the multi-lane or multi-bay stations in the U.S. The four types of Austrian facility layouts include a combined lane and box* facility, a double or triple box facility, a mini-station and a mobile semi-trailer diagnostic facility. Each is briefly described below:

  - Lane and Box. The only combined lane and box facility is at the OAMTC national headquarters in Vienna. It is also the largest of the 89 diagnostic facilities. The facility contains individual boxes (11 x 11 meters) for electronic engine analysis and special troubleshooting, plus two inspection lanes which contain five stations for the compulsory government safety inspection and seven stations for the comprehensive inspection (government inspection plus two additional stations).

  - Double and Triple Box Stations. The double and triple box facilities are fairly new facilities that have been built in some of the larger towns and villages. They contain two or three inspection boxes, plus offices and other auxiliary spaces.

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* A box is similar to a bay but is slightly larger.

  - Mini-Stations. The mini-stations are small, single-bay (5.5 x 8 meters) satellite units located in small villages and other outlying areas.

  - Mobile Facilities. The OAMTC has purchased three of the semi-trailer mobile diagnostic units manufactured by the German firm Koegel. A detailed description of these units is provided in the discussion of German diagnostic facilities that follows.

- Equipment. The types of equipment and predominant makes found in the Austrian diagnostic facilities include the following:

  - Engine analyzers (Sun, Bosch)
  - Emission analyzers (Bosch, Junkalor, Horiba, Sun)
  - Volt/Ampere Tester (Sun)
  - Compression Tester (Hellige, Motometer)
  - Brake Fluid Tester (Castrol)
  - Shock Absorber Tester (Boge).

GERMANY

The Allgemeiner Deutscher Automobil-Club e.V. (ADAC) first started offering headlight aim and other inspections in 1962. The inspection stations were enclosed in tents. After several days in one community the entire facility was packed up and moved to another location. In an effort to simplify operations and save time, the ADAC developed the idea of installing its test equipment in mobile vans. The first experiment was undertaken in 1968 on a trial basis, and the concept proved an immediate success.

The ADAC now operates 78 mobile diagnostic testing units, each of which consists of a tractor truck and trailer. The club employs Daimler-Benz tractor trucks weighing approximately 7.3 U.S. tons. The trailer is manufactured by the firm Koegel KG in Ulm, West Germany. It measures 26.25 feet long and 7.9 feet wide, and weighs between 7.2 and 9.8 U.S. tons. The complete specifications for the unit are presented in Table VI-2. Figure VI-2 illustrates a typical mobile testing unit.

The front portion of the trailer contains a full equipment inventory and operational systems such as a self-contained generator, switchbox, extension cables, replacement parts and tools. The mid section houses the actual testing platform with approach and exit ramps. A customer waiting room is located in the rear portion of the trailer, with two entrances provided for testing personnel.

TABLE VI-2. DIMENSIONAL, WEIGHT AND ELECTRICAL SYSTEM SPECIFICATIONS FOR INSPECTION SERVICE TRACTOR TRAILERS

Manufacturer:		F.X. Kogel, GmbH (Inc.) Automotive Works Ulm/Donau, Daimlerstr. 18
Dimensions:		
Trailer Interior		7650 x 2100 x 2700 mm
	(about)	25.1' x 6.9' x 8.8'
Trailer Exterior		7900 x 2260/2350 x 3450 mm
	(about)	26' x 7.4'/7.7' x 11.3'
Total Length with Tractor		10,500 mm (about 34.4')
Total Height		3,550 mm (about 11.6')

Weight Specifications:

Trailer Weight on Fifth Wheel: 3200 - 3300 kilogram forces, depending upon type.

Trailer: Allowed Total Weight: 6200 - 6800 (about 6.8 - 7.5 U.S. tons), depending upon type.

Net Weight: 6200 - 6800 kg (same as above), depending upon type.

Tractor Truck: Allowed Total Weight: 5990 - 6600 kg (about 6.6 - 7.2 U.S. tons), depending upon type.

Net Weight: 2820 - 3170 kg (about 3.1 - 3.5 U.S. tons), depending upon type.

Truck and Trailer Combined: Allowed Total Weight: 8990 - 10,100 kg (about 9.9 - 11.1 U.S. tons), depending upon type.

Electrical System:

380 volts(50 hertz, single phase with at least a 15 amp circuit breaker)

Fuel Tank Capacities for Self-Contained Electrical Generator:

1 x 20 liters (about 4.4 gals.) 1 x 100 liters (about 22 gals.)

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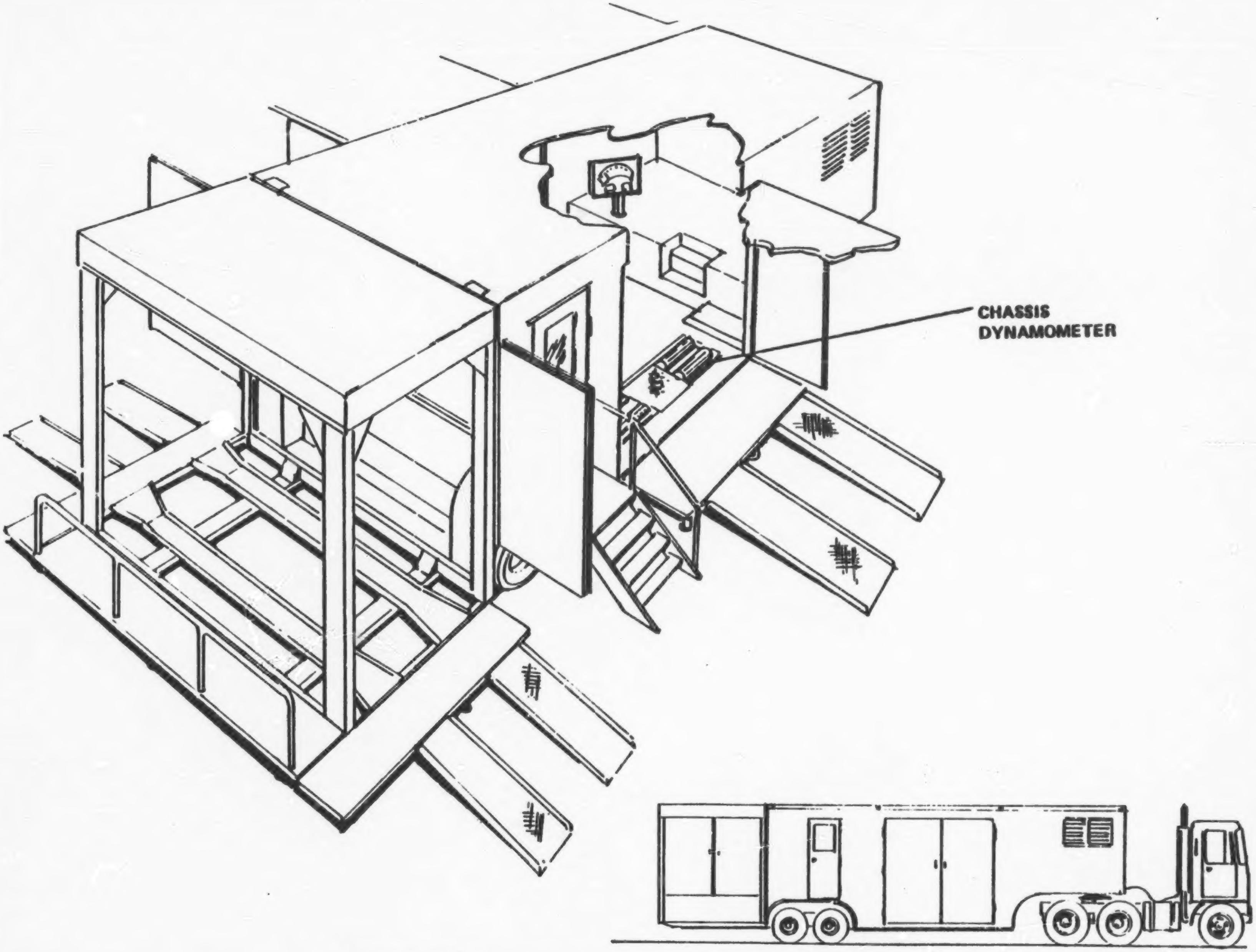
CHASSIS
DYNAMOMETER

FIGURE VI-2. MOBILE TRACTOR TRAILER USED FOR DIAGNOSTIC INSPECTION IN GERMANY AND AUSTRIA

Many of the vans are equipped to test only one vehicle parameter or component such as speedometer operation, brakes, shock absorbers, engine condition and wheel alignment. Other units are outfitted to perform a combination of these tests. Each vehicle can be re-outfitted to perform another test in approximately two hours.*

Details of the test equipment, vehicle inspection capacity and inspector skill levels are provided below.

- Types of Inspection Equipment. The ADAC mobile testing units provide one or more of the following inspections and equipment:
  - Brake test using a Hofmann Brekon I roller brake tester.
  - Shock absorber test using a Boge shock tester
  - Speedometer test using a test instrument specially developed by the ADAC. The unit consists of a testing platform with revolving rollers, an activator, and an electronic speed indicator.
  - Front end alignment check using a Polycontrol PCD or PCDA tester to measure toe-in, camber, caster and differential turning angle (toe-out) by means of an electronic measuring procedure.
  - Engine test using either a Sun SMT 89 or EMT 1010 engine analyzer. Dynamic engine tests are performed using either a Hofmann Dynakon or Bosch LPS 002 chassis dynamometer.
  - Headlight test using a Hella headlight adjustment and testing unit.
- Total Inspection Capacity. According to information from the ADAC central office, the mobile inspection units visit 4,000 inspection sites in the Federal Republic of Germany annually, and perform approximately 1 million individual inspections. The average number of inspections performed by each vehicle is 70 per day. This number varies, however, according to the length of time required to perform each particular type of inspection.

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* Selected trailers, particularly those used by the OAMTC in Austria, are also eqipped with portable hoists to allow underbody inspections.

- Inspector Skill Level. The mobile inspection units are staffed by employees of the ADAC Street Patrol. Members of the Patrol are fully trained automobile mechanics and electricians with several years of professional and practical experience in automotive service. They receive instruction on the diagnostic testing equipment from the instrument manufacturers. In addition, the ADAC Central Office distributes circular letters and receives daily reports from the field on technical matters pertaining to the diagnostic testing program.

NETHERLANDS

The Algemene Nederlandse Wielrÿders Bond (ANWB) operates 25 diagnostic inspection facilities in the Netherlands. The layout of the facilities varies; some have a flow-through lane design and others have from two to ten bays. According to J.D. Plaisier, Director of Technical Inspections, the latest development is a combination of both systems; the brake and lighting tests are performed sequentially in a lane and the body, underbody, wheel alignment and electrical tests are performed in a bay, as shown in Figure VI-3.

An example of the ANWB diagnostic inspection form is presented in Appendix E. Information on the inspector experience requirements, vehicle processing times and equipment at the Dutch diagnostic facilities is described below.

- Inspector Experience Requirements. Testing mechanics at the ANWB must be at least 23 years old, have at least five years experience with different vehicle makes and have a 1st mechanic diploma. They must also have some insight into human nature and be able to conduct a conversation with motorists on the technical aspects of the vehicles inspected.

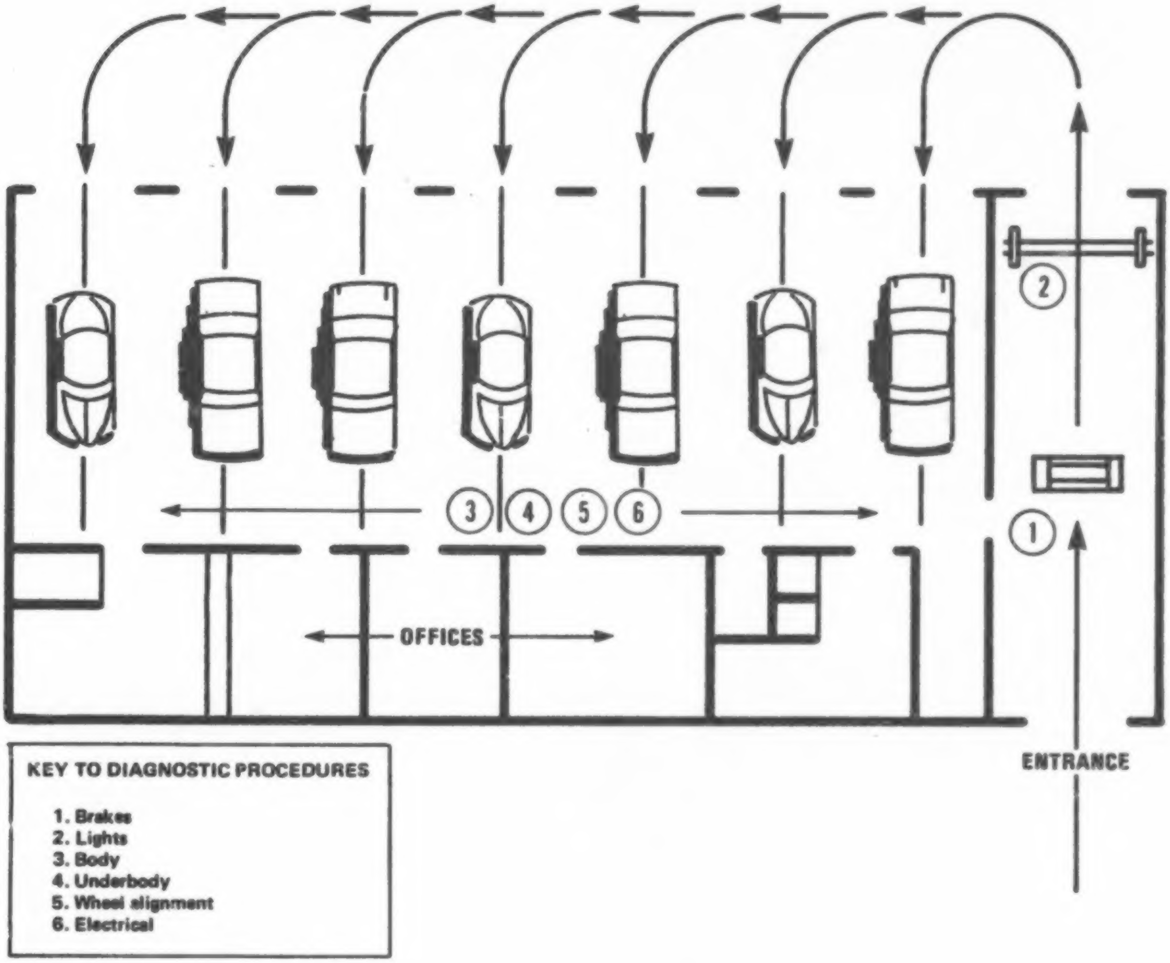
- Vehicle Processing Time. An automobile inspection takes about 90 minutes including a pre-inspection interview and post-inspection counseling. The average facility inspection rate is five vehicles per inspector per day, and the total annual throughput is approximately 7,000 vehicles per inspection facility.

- Equipment. Principal testing equipment found in the ANWB diagnostic facilities includes the following:

  - Roller type brake testers (Schenck, Hoffman)

  - Oscilloscopes (Crypton)

FIGURE VI-3. DIAGNOSTIC FACILITY LAYOUT, NETHERLANDS, ANWB


②
①
③ ④ ⑤ ⑥
OFFICES
ENTRANCE
KEY TO DIAGNOSTIC PROCEDURES
1. Brakes
2. Lights
3. Body
4. Underbody
5. Wheel alignment
6. Electrical

BEST DOCUMENT AVAILABLE

- Headlight tester (Hella)
- Chassis Dynamometers (Schenck)
- Wheelspinners (Grasso Pneumatic)
- Wheel Alignment (V.L.C. Portaflex and Hunter Electron A-Line Type 57M)
- Carlifts (Koni 2.5 and 3.5 ton models with NENAB pneumatic crossbeam)
- CO - CO^2 Tester (Sun)
- Tools and other simple equipment, including headlight adjusters and wheel spinners.

NEW ZEALAND

The New Zealand Automobile Association acts as the national secretariat for 15 constituent associations within the country. Each of the constituent associations provides inspection facilities at its headquarters and in some of the branch office locations, so that diagnostic inspection facilities are found in a total of 26 cities in New Zealand. According to the Secretary-General of the New Zealand Automobile Association, the constituent associations perform a total of 40,000 inspections per year.

Employees of the diagnostic facilities are certified automobile mechanics, many of whom have been employed by their respective associations for five to ten years. Equipment used in the facilities includes Sun dynamometers, Vane engine analyzers and Allen and Blackhawke infrared emission analyzers. Examples of the types of inspection services provided include the following:

- Pre-Purchase/Owner's Own Vehicle Inspection. This inspection is recommended before a second-hand car is purchased or when a motorist is contemplating major repairs to a currently owned vehicle.
- New Car Warranty Inspection. From this inspection owners are given a report which lists any necessary repairs or replacement of components which are covered by the vehicle warranty.
- Tunescope Inspection. This inspection involves testing the engine with an engine analyzer/scope. Tests include the electrical components, carburetor and engine compression.

- Wheel Alignment. Examination of the front and rear suspension, including springs, shock absorbers, stabilizers, wheel alignment, steering geometry and tire pressure.

- Complete Diagnostic Inspection. This service consists of an overall examination of the car, including a speedometer check on the dynamometer, engine analysis, cooling system, brake system, suspension checks, body condition, tires, lights, underbody, fuel system, instruments and a road test. The duration of this examination is up to three and one-half hours.

Some of the constituent automobile associations in New Zealand also offer inspection services for motorcycles, trucks and caravans. The parameters and components included in these inspections are the following:

- Motorcycle Check. This limited inspection includes an examination of the frame, steering, springs and engine compression.

- Truck Check. This check applies to trucks over two tons; smaller trucks and vans are inspected on the same basis as cars. The examination includes the engine, gearbox, clutch and differential.

- Caravan Check. The diagnostic facilities will inspect trailers or recreational vehicles. The examination includes an inspection of the body and interior condition, electrical system, tires, suspension, water cooling, fuel system and brakes.

APPENDIX A

AUTO CLUB CHARACTERISTICS AND EFFECTIVENESS SUMMARIES

	Page Number
Baltimore, Maryland	A-1
Philadelphia, Pennsylvania	A-15
St. Louis, Missouri	A-31
Toronto, Ontario	A-60
Vancouver, British Columbia	A-70
Montreal, Quebec	A-79
Sainte-Foy, Quebec	A-88
San Jose, California	A-97
San Francisco, California	A-110

AUTO CLUB CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: AAA Diagnortic Center
Mobile Unit
1401 Mt. Royal Avenue
Baltimore, MD 21217

2. Contact Name and Number: William R. Norris
Director of Automotive Services
(301) 462-4000 Ext. 273

3. General Description of Facility: This facility is a limited inspection mobile unit that tests the vehicle's engine and charging system and includes a visual underhood inspection plus a tire condition check.

The van began operating in 1977. The unit is set up at the Baltimore AAA headquarters parking lot four days a week. The fifth day the unit travels to outlying areas such as Annapolis, Columbia and Towson. The travel schedule is established a year in advance.

4. Vehicle Types Inspected: All light duty vehicle types. No motorcycles.

5. Type of Inspection Services: The Baltimore AAA diagnostic van provides three types of inspection services:

. Engine, Charging and Starting Diagnostic Test (includes emissions analysis)	$21.95 (for members)
. Charging and Starting Diagnostic Test	7.95
. Reinspection	3.00

Repairs are not performed.

6. Operating Hours: Tues.-Fri. - 9:00 a.m. to 5:00 p.m.
Saturday - 8:30 a.m. to 4:30 p.m.

7. Physical Area of Inspection Facility: The inspections are conducted at the immediate rear of the van. The inspections, which are all underhood, require a working space of one vehicle length (18 feet) by approximately 7.5 feet width, plus a working area in front of the vehicle of 4 feet by 7.5 feet.

8. Inspection Station Dimensions: Only one vehicle can be brought up to the rear of the van at a time. The dimensions of the inspection station are thus the length of a vehicle, the length of the van (approximately 16 feet) by the van width (allowing some room for entry) of about 7.5 feet, plus a working space of 4 feet for the inspector, with a total space of 38 by 7.5 feet.

9. Number of Lanes/Bays: Only one vehicle can be inspected at a time in this mobile inspection station.

10. Queueing Area: The inspections are conducted by appointment and at a low rate. No queueing area is needed or used. An access lane is required for vehicles to approach the van.

11. Parking Area: Three parking spaces have been reserved by AAA for customers of the inspection facility at the HQ location.

12. Facility Diagram and Equipment Location: A diagram of the AAA Mobile Unit is shown in Figure 1.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Opened: July 1978.

2. Construction Type and Material: The mobile unit is a 1978 Ford Parcel Delivery Van, 3/4 ton, standard transmission, six cylinder engine. The van was modified to accommodate the inspection equipment. The van is 16 feet long, 7.5 feet wide and over 6 feet high.

3. Patron Accommodations: There is an area of approximately 4.5 feet long by 7.5 feet wide inside the van for counseling purposes. The area contains chairs and a conference table. A wall display of inspection procedures and defective components is mounted in the trailer to inform the customer of the processes used in the inspection.

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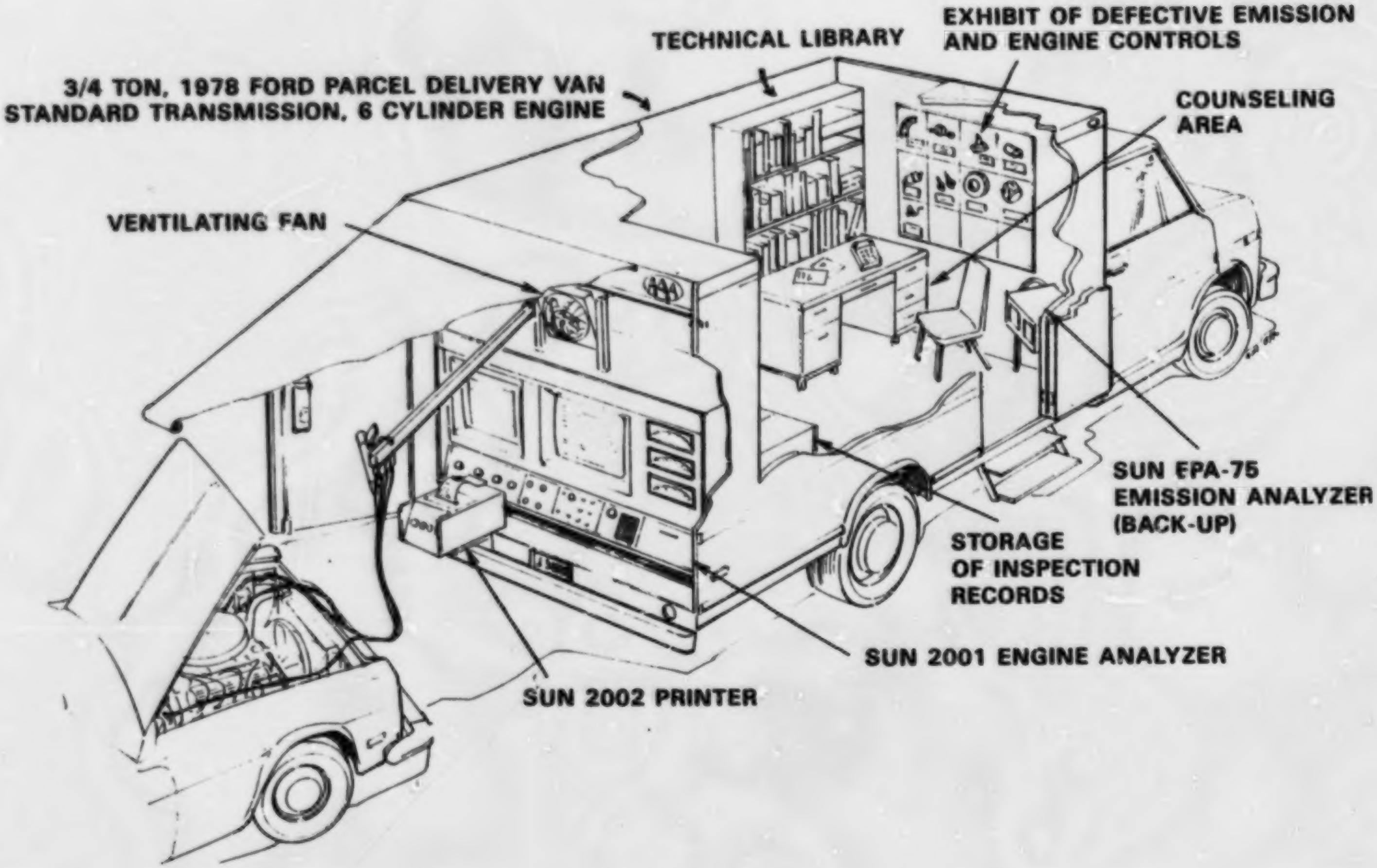
TECHNICAL LIBRARY
EXHIBIT OF DEFECTIVE EMISSION AND ENGINE CONTROLS
3/4 TON, 1978 FORD PARCEL DELIVERY VAN
STANDARD TRANSMISSION, 6 CYLINDER ENGINE
COUNSELING AREA
VENTILATING FAN
SUN EPA-75 EMISSION ANALYZER (BACK-UP)
STORAGE OF INSPECTION RECORDS
SUN 2001 ENGINE ANALYZER
SUN 2002 PRINTER

FIGURE 1. LAYOUT OF MARYLAND AAA DIAGNOSTIC VAN

4. Ventilation System Design: A ceiling fan is mounted in the van to circulate air in the counseling area. A second fan is mounted at the rear of the van which directs air into the area in which the inspector works (under the hood of the vehicle under inspection).

5. Safety Accommodations: The General Industry Standards published by OSHA (29 CFR 1910) and revised in 1976 do not provide specific requirements for diagnostic vans. General safety requirements that may be applied to the van are carefully observed by the AAA of Maryland. These include:

   - Provision of general fault interceptors in the electrical hook-ups.
   - Use of properly insulated wiring.
   - Use of correct size bolts for anchoring testing equipment.
   - Use of safety pylons.
   - Stair treads (into van) are painted yellow and equipped with grips.

6. Noise Accommodations: The inspections are conducted outdoors while the counseling is indoors. There is no further need to baffle the noise.

III. STEPS OF INSPECTION PROCESS

1. Check-In: A vehicle service history is collected for each vehicle that undergoes a diagnostic inspection. All diagnostic results are maintained on file by the Maryland AAA. The vehicle history checklist is shown in Figure 2 and includes identification of any performance problems, the type of fuel used, typical driving cycle and vehicle maintenance and repair details.

   Part of the Auto Club's service is to send out a reminder card for an annual diagnostic check. The reminder card is shown in Figure 3. Figure 4 shows an appointment notice that is sent to verify the motorist's appointment time.

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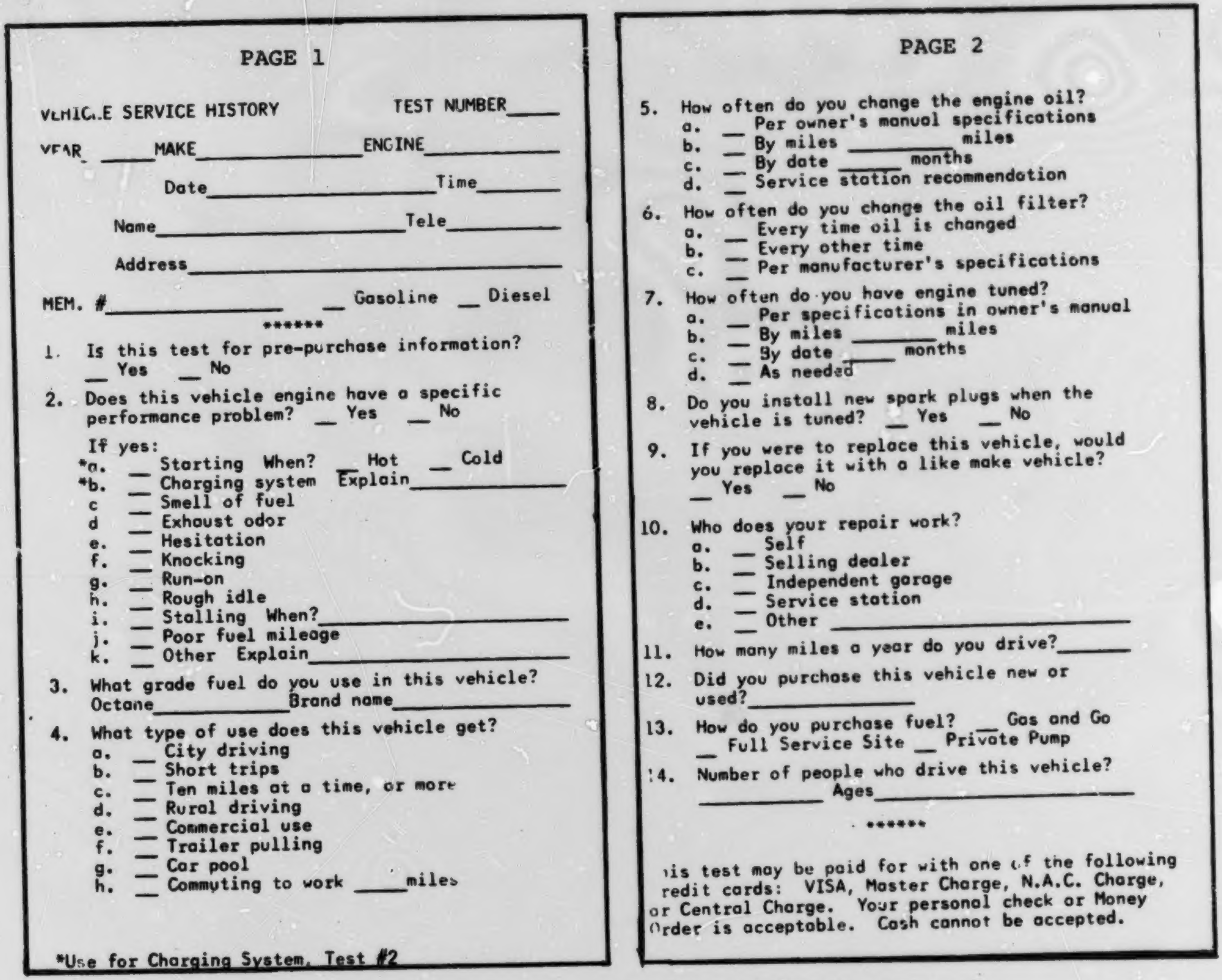


PAGE 1

VEHICLE SERVICE HISTORY TEST NUMBER____

YEAR ____MAKE______________ENGINE__________

Date__________________Time______

Name________________Tele________

Address__________________________

MEM. #____________ __ Gasoline __ Diesel

******

1. Is this test for pre-purchase information?
   __ Yes __ No
2. Does this vehicle engine have a specific performance problem? __ Yes __ No

   If yes:
   - *a. __ Starting When? __ Hot __ Cold
   - *b. __ Charging system Explain__________
   - c __ Smell of fuel
   - d __ Exhaust odor
   - e. __ Hesitation
   - f. __ Knocking
   - g. __ Run-on
   - h. __ Rough idle
   - i. __ Stalling When?______________
   - j. __ Poor fuel mileage
   - k. __ Other Explain______________
3. What grade fuel do you use in this vehicle?
   Octane__________Brand name__________
4. What type of use does this vehicle get?
   - a. __ City driving
   - b. __ Short trips
   - c. __ Ten miles at a time, or more
   - d. __ Rural driving
   - e. __ Commercial use
   - f. __ Trailer pulling
   - g. __ Car pool
   - h. __ Commuting to work ____miles

*Use for Charging System, Test #2

PAGE 2

5. How often do you change the engine oil?
   - a. __ Per owner's manual specifications
   - b. __ By miles ________ miles
   - c. __ By date _____ months
   - d. __ Service station recommendation
6. How often do you change the oil filter?
   - a. __ Every time oil is changed
   - b. __ Every other time
   - c. __ Per manufacturer's specifications
7. How often do you have engine tuned?
   - a. __ Per specifications in owner's manual
   - b. __ By miles ______ miles
   - c. __ By date ____ months
   - d. __ As needed
8. Do you install new spark plugs when the vehicle is tuned? __ Yes __ No
9. If you were to replace this vehicle, would you replace it with a like make vehicle?
   __ Yes __ No
10. Who does your repair work?
    - a. __ Self
    - b. __ Selling dealer
    - c. __ Independent garage
    - d. __ Service station
    - e. __ Other ______________
11. How many miles a year do you drive?______
12. Did you purchase this vehicle new or used?__________
13. How do you purchase fuel? __ Gas and Go
    __ Full Service Site __ Private Pump
14. Number of people who drive this vehicle?
    ________ Ages______________

******

his test may be paid for with one of the following redit cards: VISA, Master Charge, N.A.C. Charge, or Central Charge. Your personal check or Money Order is acceptable. Cash cannot be accepted.

FIGURE 2. MARYLAND AAA VEHICLE HISTORY CHECKLIST

A properly adjusted engine uses less fuel. Just a reminder that it has been about a year since your car was last evaluated by our Diagnostic Testing Unit. In the interest of vehicle maintenance for fuel economy, you may wish to have a test performed annually.

If you are interested, please call for an appointment.

AUTOMOBILE CLUB OF MARYLAND
Diagnostic Services
(301) 462-4000 Extension 301

FIGURE 3. REMINDER CARD FOR ANNUAL DIAGNOSTIC CHECK

Time has been allotted to you for diagnostic testing of your motor vehicle on   at

If you are unable to keep the appointment, please contact us as soon as possible so another customer may use this allotted time.

AUTOMOBILE CLUB OF MARYLAND
Automotive Services Department
(301) 462-4000 Extension 301

FIGURE 4. APPOINTMENT NOTICE

2. Test Sequence: The utilization of automated and visual inspection permits some concurrent testing. The inspection procedure, in general, adheres to the following sequence:

- Timing, compression and electrical analysis of engine, emissions analysis (moderate and fast idle mode at 1500 and 2500 RPM).
- Visual underhood inspection (carburetor, air filter, oil filter, radiator, spark plugs, points)
- Tire pressure check.

Figure 5 illustrates the elements of analysis conducted during this inspection.

3. Data Handling: Manual. Test results are entered on the checksheet (Figure 5) as the inspection progresses. Following the inspection the inspector compares the results with the vehicle specifications.

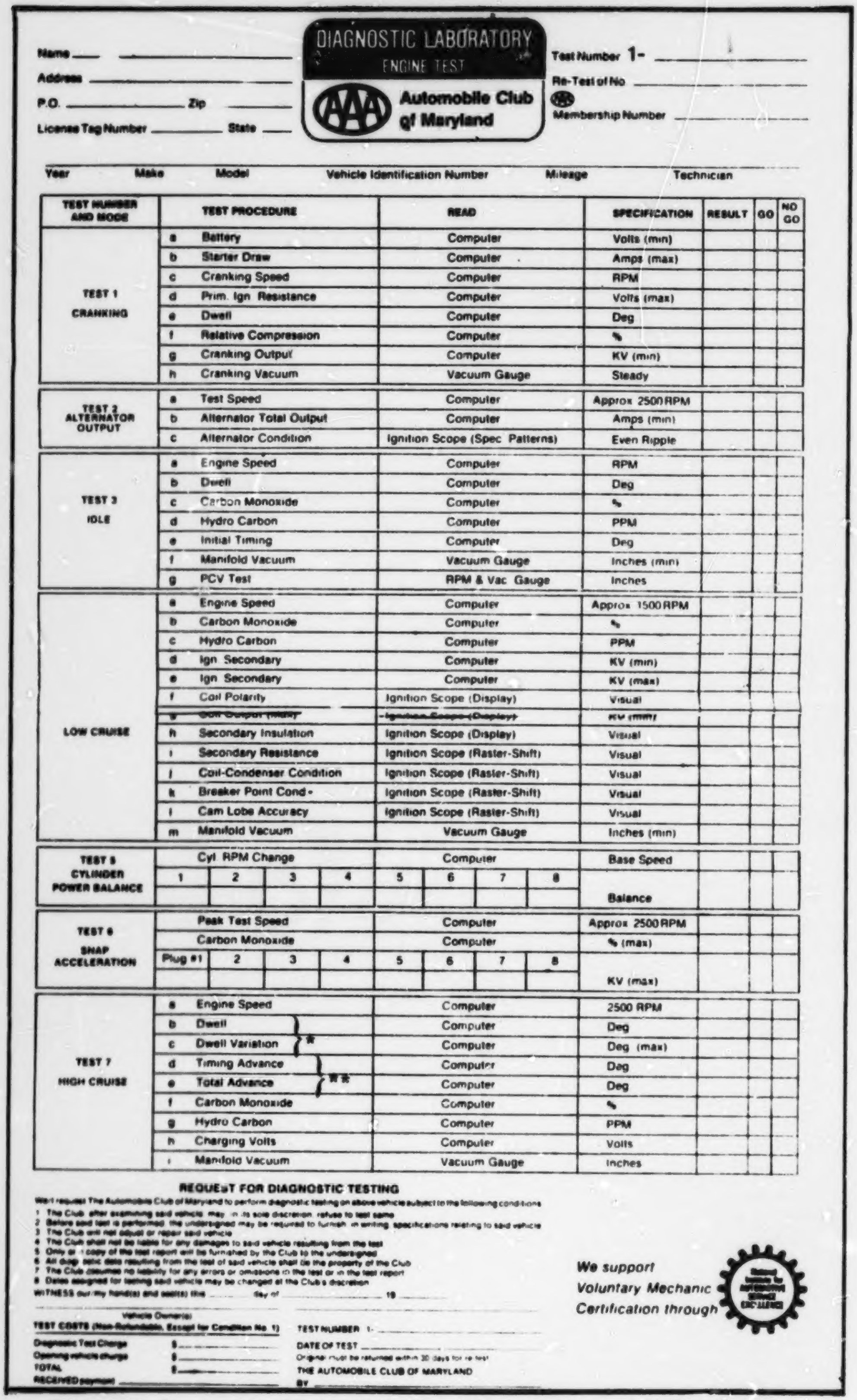
4. Check-Out: The results of the testing procedure are collected on the Diagnostic Test Results Form shown in Figure 5. The form provides space for the inspector to record quantitative test results as well as an indication of the "go" or "no-go" status of each parameter.

Once the testing has been completed, the inspector meets with the patron in a counseling area inside the van. The inspector reviews the detailed test results with the customer and prepares a written, prioritized list of recommended repair actions. The Defect Report Form is shown in Figure 6.

The counseling session lasts approximately 10-15 minutes. Motorists receive copies of the diagnosis results, defect report and a brochure, "Facts About the Diagnostic Laboratory Engine Test." The nine-page brochure explains the diagnostic test procedure by reviewing each of the tests: battery, starter, cranking speed, primary ignition resistance, dwell and so on. The booklet is not illustrated.

5. Comments: An additional consumer information service that is provided by the Diagnostic Van is a display board showing major emission and engine components labeled by name. During a counseling session, the inspector can demonstrate the operation of these components. Included are emissions control devices, carburetor, components, miscellaneous hoses, etc. Charts showing inspection procedures are also displayed on the walls.

BEST DOCUMENT AVAILABLE



DIAGNOSTIC LABORATORY
ENGINE TEST

Automobile Club
of Maryland

Name ____________
Address ____________
P.O. ____________ Zip ______
License Tag Number ________ State ____

Test Number 1- ____________
Re-Test of No ____________
Membership Number ____________

Year Make Model Vehicle Identification Number Mileage Technician

TEST NUMBER AND MODE		TEST PROCEDURE	READ	SPECIFICATION	RESULT	GO	NO GO
TEST 1 CRANKING	a	Battery	Computer	Volts (min)			
	b	Starter Draw	Computer	Amps (max)			
	c	Cranking Speed	Computer	RPM			
	d	Prim. Ign Resistance	Computer	Volts (max)			
	e	Dwell	Computer	Deg			
	f	Relative Compression	Computer	%			
	g	Cranking Output	Computer	KV (min)			
	h	Cranking Vacuum	Vacuum Gauge	Steady			
TEST 2 ALTERNATOR OUTPUT	a	Test Speed	Computer	Approx 2500 RPM			
	b	Alternator Total Output	Computer	Amps (min)			
	c	Alternator Condition	Ignition Scope (Spec Patterns)	Even Ripple			
TEST 3 IDLE	a	Engine Speed	Computer	RPM			
	b	Dwell	Computer	Deg			
	c	Carbon Monoxide	Computer	%			
	d	Hydro Carbon	Computer	PPM			
	e	Initial Timing	Computer	Deg			
	f	Manifold Vacuum	Vacuum Gauge	Inches (min)			
	g	PCV Test	RPM & Vac Gauge	Inches			
LOW CRUISE	a	Engine Speed	Computer	Approx 1500 RPM			
	b	Carbon Monoxide	Computer	%			
	c	Hydro Carbon	Computer	PPM			
	d	Ign Secondary	Computer	KV (min)			
	e	Ign Secondary	Computer	KV (max)			
	f	Coil Polarity	Ignition Scope (Display)	Visual			
	~~g~~	~~Coil Output (min)~~	~~Ignition Scope (Display)~~	~~KV (min)~~			
	h	Secondary Insulation	Ignition Scope (Display)	Visual			
	i	Secondary Resistance	Ignition Scope (Raster-Shift)	Visual			
	j	Coil-Condenser Condition	Ignition Scope (Raster-Shift)	Visual			
	k	Breaker Point Cond -	Ignition Scope (Raster-Shift)	Visual			
	l	Cam Lobe Accuracy	Ignition Scope (Raster-Shift)	Visual			
	m	Manifold Vacuum	Vacuum Gauge	Inches (min)			
TEST 5 CYLINDER POWER BALANCE		Cyl RPM Change	Computer	Base Speed			
		1 2 3 4	5 6 7 8	Balance			
TEST 6 SNAP ACCELERATION		Peak Test Speed	Computer	Approx 2500 RPM			
		Carbon Monoxide	Computer	% (max)			
		Plug #1 2 3 4	5 6 7 8	KV (max)			
TEST 7 HIGH CRUISE	a	Engine Speed	Computer	2500 RPM			
	b	Dwell	Computer	Deg			
	c	Dwell Variation *	Computer	Deg (max)			
	d	Timing Advance	Computer	Deg			
	e	Total Advance **	Computer	Deg			
	f	Carbon Monoxide	Computer	%			
	g	Hydro Carbon	Computer	PPM			
	h	Charging Volts	Computer	Volts			
	i	Manifold Vacuum	Vacuum Gauge	Inches			

REQUEST FOR DIAGNOSTIC TESTING

We/I request The Automobile Club of Maryland to perform diagnostic testing on above vehicle subject to the following conditions

1 The Club after examining said vehicle may in its sole discretion refuse to test same
2 Before said test is performed the undersigned may be required to furnish in writing specifications relating to said vehicle
3 The Club will not adjust or repair said vehicle
4 The Club shall not be liable for any damages to said vehicle resulting from the test
5 Only one copy of the test report will be furnished by the Club to the undersigned
6 All diagnostic data resulting from the test of said vehicle shall be the property of the Club
7 The Club assumes no liability for any errors or omissions in the test or in the test report
8 Dates assigned for testing said vehicle may be changed at the Club's discretion

WITNESS our/my hand(s) and seal(s) this ______ day of ____________ 19 ______

Vehicle Owner(s)

TEST COSTS (Non-Refundable, Except for Condition No. 1)
Diagnostic Test Charge $______
Opening vehicle charge $______
TOTAL $______
RECEIVED payment ____________

TEST NUMBER 1- ____________
DATE OF TEST ____________
Original must be returned within 30 days for re-test
THE AUTOMOBILE CLUB OF MARYLAND
BY ____________

We support
Voluntary Mechanic
Certification through

FIGURE 5. AAA OF MARYLAND DIAGNOSTIC CHECKSHEET

* Dwell and dwell variation are not measured on vehicles with electronic ignition.

** For late model GM cars, the GM 3-C system diagnostic procedure is substituted for the timing measurement. In Ford and Chrysler new cars the test procedure is the same as for older cars.

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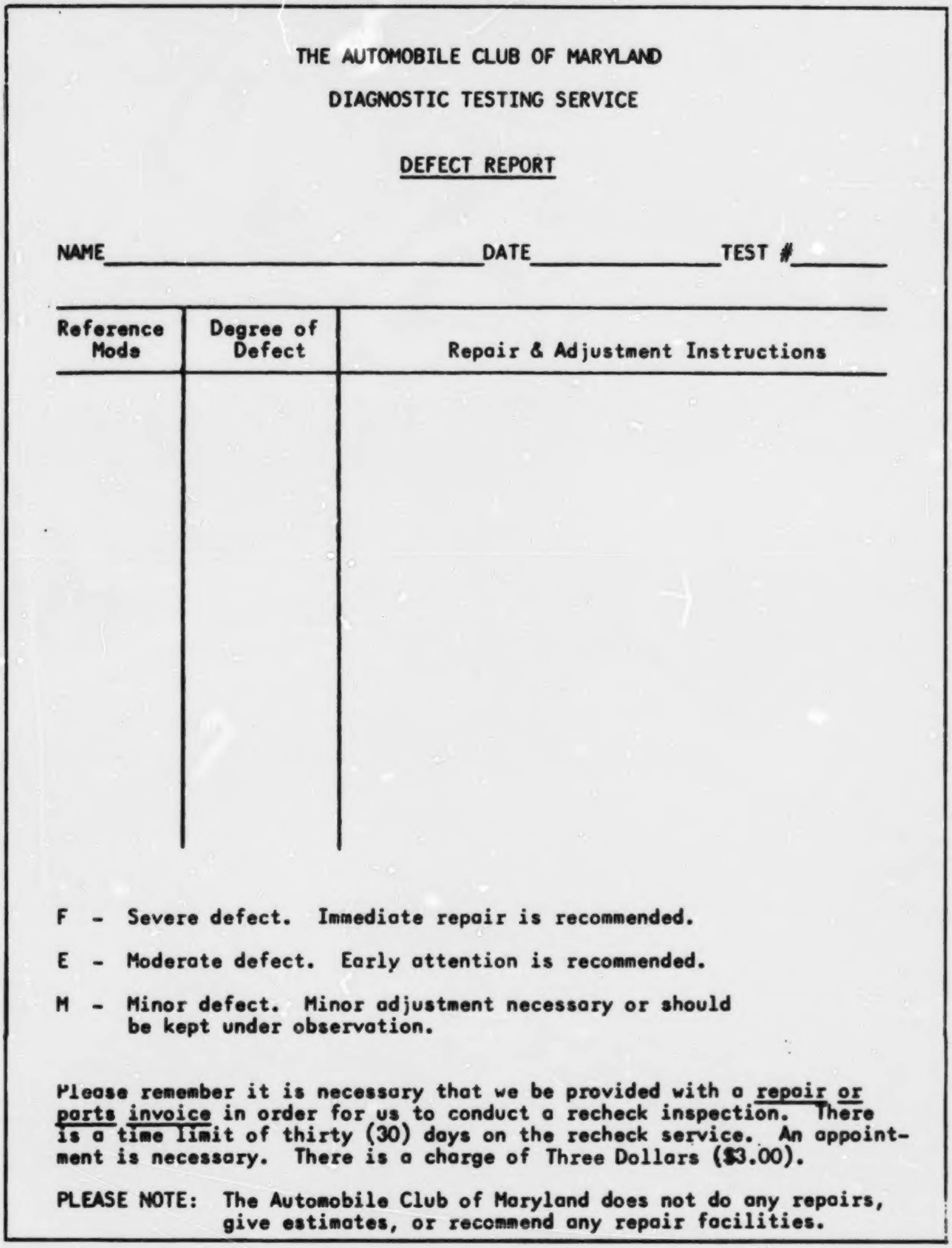

THE AUTOMOBILE CLUB OF MARYLAND

DIAGNOSTIC TESTING SERVICE

DEFECT REPORT

NAME______________________________DATE_______________TEST #_______

Reference Mode	Degree of Defect	Repair & Adjustment Instructions

F - Severe defect. Immediate repair is recommended.

E - Moderate defect. Early attention is recommended.

M - Minor defect. Minor adjustment necessary or should be kept under observation.

Please remember it is necessary that we be provided with a repair or parts invoice in order for us to conduct a recheck inspection. There is a time limit of thirty (30) days on the recheck service. An appointment is necessary. There is a charge of Three Dollars ($3.00).

PLEASE NOTE: The Automobile Club of Maryland does not do any repairs, give estimates, or recommend any repair facilities.

FIGURE 6. AAA OF MARYLAND DEFECT REPORT FORM

IV. FEES

1. Diagnostic Inspection: $21.95 for AAA members
$28.95 for non-members

2. Other Services: $3.00 charge for reinspection.

V. TEST EQUIPMENT

1. Brakes: Not tested.

2. Alignment: Not tested.

3. Headlight Aim: Not tested.

4. Lift: None.

5. Emissions Analyzer: Sun HC/CO Analyzer is part of the 2001 engine analyzer. Also, a Sun EPA-75 Analyzer is used in special situations.

6. Dynamometer: None.

7. Noise: Not tested.

8. Starter: Sun VAT-40

9. Other: Sun 2001 engine analyzer*, Sun 2002 printer*, hand tools.

10. Plans for Replacement: The equipment was purchased three years ago. There are plans to replace it after the fourth year.

11. Back-Up Provisions: None.

12. Technical Library: Included in the library are the following booklets and manuals:

- Mitchell Manuals for Automotive Professionals
    - Tune Up Service and Repair Manuals for Domestic Cars, Vols. 1 and 2, and Domestic Trucks
    - Emission Control Service and Repair for Domestic and Imported Cars
    - Teaching books for emissions

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* Engine test equipment is powered by commercial 60 hertz electricity obtained from a local gas station or garage. An oversized #10 extension cord is used with an adapted plug.

- Sun tester bulletins
- Sun Product Support System (teaching book)
- 1980 specifications for Ford, G.M. and Chrysler
- 1979 specifications for Ford/Lincoln Mercury and Oldsmobile, Plymouth, Pontiac
- Advanced Systems Diagnostic Computer Operator's Manual.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Maintenance: All equipment is checked daily prior to operation. Any minor periodic or scheduled maintenance on the Sun 2001 is performed by the inspector. In addition, the engine analyzer is taken once a month to the Sun manufacturer's service center for a more in-depth cleaning and calibration, including removal of dust from the circuit boards.

2. Frequency of Gas Calibration for Emission Analyzer: Monthly.

VII. FACILITY STAFFING

Program Director: William R. Norris, Director of Automotive Services

Others: One senior mechanic
One mechanic intern.

VIII. TRAINING

1. Inspector Experience Requirements: Qualification requirements for inspectors include the ability to communicate well and to enjoy meeting and speaking with people. Since the inspector performs both the inspection and counseling, these qualifications are considered to be very important.

[redacted]

Technical qualifications for an inspector intern include as a minimum NIASE certification for Engine Tune-Up. Additional desirable qualifications include NIASE certification for Engine Automotive Electrical Systems and Engine Repair. No previous experience beyond the NIASE certification is required for an inspector intern. Technical requirements for the Senior Inspector (individual in charge of the Diagnostic Van) include a NIASE master's license with certification in all testing areas.

2. Employee Training Provisions: The intern position is a training position.

3. Technical Update Meetings: Periodic staff meetings are called by the director.

IX. QUALITY CONTROL

1. Supervision for Inspectors: The program director provides help on stubborn problems.

2. Surveys of Customer Satisfaction: 25-35 questionnaires are mailed to former customers every month. The biggest complaint is that people would like to have a full rather than the present limited diagnostic inspection.

3. Criteria for Failure: The AAA uses Federal standards and manufacturers' specifications (labels under the hood for engine adjustments are adequate, even for new vehicles).

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Reinspections are performed for a fee of $3.00 with the motorist required to present a copy of the repair receipt at the time of reinspection. The Auto Club has observed an increase in the percentage of repair work that is performed correctly over the past three years. The percentage of correct initial repair work has increased to 50 percent, and the quality of repairs seems to be improving.

[redacted]

XI. CUSTOMER INTERFACE

1. Counseling: A review is made of the results of the engine inspection and its significance. The AAA does not provide any estimates of the cost of repairs. If the customer requests it, the inspector will provide a list of local service garages which are approved by the AAA nationwide Approved Auto Repair Services Program. The customer is encouraged to get an estimate from the repair shop.

2. Additional Customer Services: None.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: 45 minutes: 30 minutes for the actual inspection, 15 minutes for counseling.

2. Theoretical Maximum Throughput: Can do two cars per hour or 16 per day.

3. Appointments Used: Yes, on half-hour intervals. Occasionally, walk-ins are accepted.

4. Busiest Time of the Year: Nice weather and Saturdays.

5. Maximum Number of Vehicles Processed for the Entire Facility: Two per hour and 16 per day.

XII. CONSUMER AND COMMUNITY RELATIONS

The director of the Baltimore AAA Diagnostic Van Program is a member of the Board of the Lincoln Technical Institute, a nearby private trade school. In this capacity he reviews candidates for scholarships to the Institute.

Another program relating to the community was a cooperative effort between the Baltimore Auto Club and the American Lung Association. From 1972 to 1976 these organizations jointly sponsored free emissions tests for 10,000 automobiles, to publicize the need to reduce automobile pollution. The project was completely funded by the AAA and the American Lung Association.

A third example of consumer/community relations is the service provided by the van in checking vehicles referred by the Maryland Consumer Protection Center. When the Center encounters a disagreement between a motorist and a repair shop, an independent, objective evaluation by the AAA diagnostic van often aids in settlement of the issue.

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment: The initial capital required for purchasing the van, Sun 2001 and 2002 (printer), small hand tools and adding necessary modification was approximately $30,000 in 1977.
2. Space Rental: None required.
3. Total Receipts: 1979 - Approximately $31,000.
4. General Expenses: $600.
5. Labor Costs: $24,852.
6. Equipment Maintenance: $2,763 (not including van).
7. Dues, Books, Periodicals: $959.
8. Income in 1979: $2,000. The diagnostic mobile unit is not quite a self-supporting operation. The Program Director's work on the program (approximately 33 percent of his time) is not charged against the diagnostic receipts.

AUTO CLUB CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address:
   Keystone Automobile Club
   Automotive Diagnostic Clinic
   3055 West Chesters Pike
   Broomall, PA 19008

2. Contact Name and Number:
   Jack E. Weber, Jr.
   Assistant Vice President
   and Director of Automotive
   Services
   (215) 864-5145

   Everett Wright
   Diagnostic Clinic Manager
   (215) 353-7900

3. General Description of Facility: This newly constructed diagnostic center opened June 30, 1980 with a layout modeled after the San Jose, California Club. The center contains four parallel bays through which vehicles are circulated for optimum throughput and inspection efficiency. The center provides a full vehicle diagnostic check of over 110 items for both members and nonmembers.

4. Vehicle Types Inspected: All passenger cars, including front-wheel drive and diesel cars, light trucks and vans, and heavy trucks up to one ton are accommodated. No dual rearwheel trucks are accepted.

5. Types of Inspection Services: The Keystone Club provides a comprehensive vehicle diagnostic check, including an underbody check, dynamic alignment check, loaded mode carburetion and ignition analysis, and brake tests. Individual system checks are conducted only after the complete vehicle diagnostic inspection has been performed. The Keystone philosophy is that in order to properly diagnose an individual malfunction, the operating condition of the vehicle as a whole must first be determined. Rechecks following repairs are also performed. No repairs or adjustments are made.

6. Hours of Operation: M-F, 8:00 a.m. to 5:00 p.m.

7. Physical Area of Inspection Facility: The inspection facility itself covers 4500 square feet. The building is fringed on three sides by parking areas and pavement and has a landscaped area in the front. The building is located off a 4-lane road in a suburb west of Philadelphia.

8. Inspection Station Dimensions: 50' x 90'.

9. Number of Lanes/Bays: Vehicles are routed in and out of an area equal to four large bays placed side by side. Three bay areas are used for the main diagnostic inspection and one is used for rechecks and more detailed inspection of suspected subsystems.

10. Bay Dimensions: Each bay is 15' x 50'.

11. Queueing Area: Vehicles are stored in the parking lot before and after the inspection process. No queueing area is required since the inspections are on an appointment basis.

12. Parking Area: Can accommodate 18 vehicles.

13. Facility Diagram and Equipment Location: A diagram of the facility is shown in Figure 1. Vehicles having a diagnostic inspection enter Bay 1, go to Bay 3 and then circle around to Bay 4. Bay 2 is reserved for rechecks and subsystem checks. Inspectors drive the vehicle through the inspection facility.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: 1979-80. Opened: June 30, 1980.

2. Construction Features: Rectangular, open building of steel, glass and cinder block. Ceiling is equipped with skylights in several areas for maximum visibility. Diagnostic bays are heated with infrared heaters. The reception area is heated with a heat pump. Doors to all four bays are equipped with sensors to open automatically in the winter. During the summer the bay doors remain open. A lunchroom equipped with sink and refrigerator and a locker room are provided for the inspectors.

3. Patron Accommodations: The facility has an air conditioned waiting lounge with magazines and a large viewing window, restrooms, and a separate counseling area.

[redacted]

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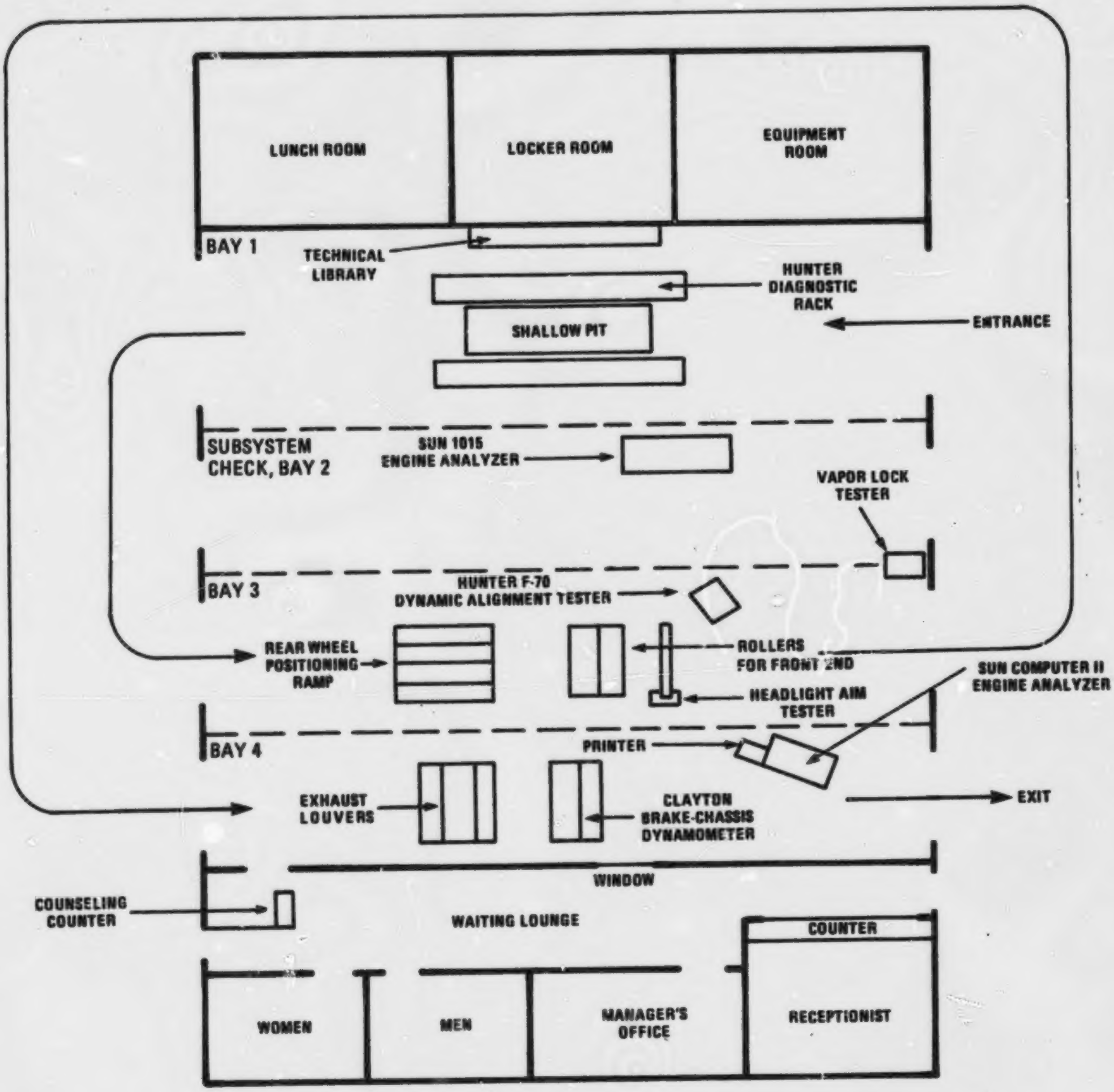

LUNCH ROOM
LOCKER ROOM
EQUIPMENT ROOM
BAY 1
TECHNICAL LIBRARY
HUNTER DIAGNOSTIC RACK
ENTRANCE
SHALLOW PIT
SUBSYSTEM CHECK, BAY 2
SUN 1015 ENGINE ANALYZER
VAPOR LOCK TESTER
BAY 3
HUNTER F-70 DYNAMIC ALIGNMENT TESTER
REAR WHEEL POSITIONING RAMP
ROLLERS FOR FRONT END
SUN COMPUTER II ENGINE ANALYZER
HEADLIGHT AIM TESTER
BAY 4
PRINTER
EXHAUST LOUVERS
CLAYTON BRAKE-CHASSIS DYNAMOMETER
EXIT
WINDOW
COUNSELING COUNTER
WAITING LOUNGE
COUNTER
WOMEN
MEN
MANAGER'S OFFICE
RECEPTIONIST

FIGURE 1. LAYOUT OF KEYSTONE AUTO CLUB

4. Ventilation System Design: The facility features a number of ventilation systems. The pit in Bay 1 and all equipment pits are ventilated and constantly purged with fresh air to remove heat and fumes. There are exhaust louvers installed behind the dynamometer which can move 10,000 cubic feet of air per minute away from the automobile while it is being tested in hi-cruise modes. The air is exhausted to a ground vent approximately 15-20 feet away from the building. A large box fan (estimated size 4' x 4') is positioned near the front end of the car while it is on the dynamometer to remove engine heat while the inspectors perform underhood checks.

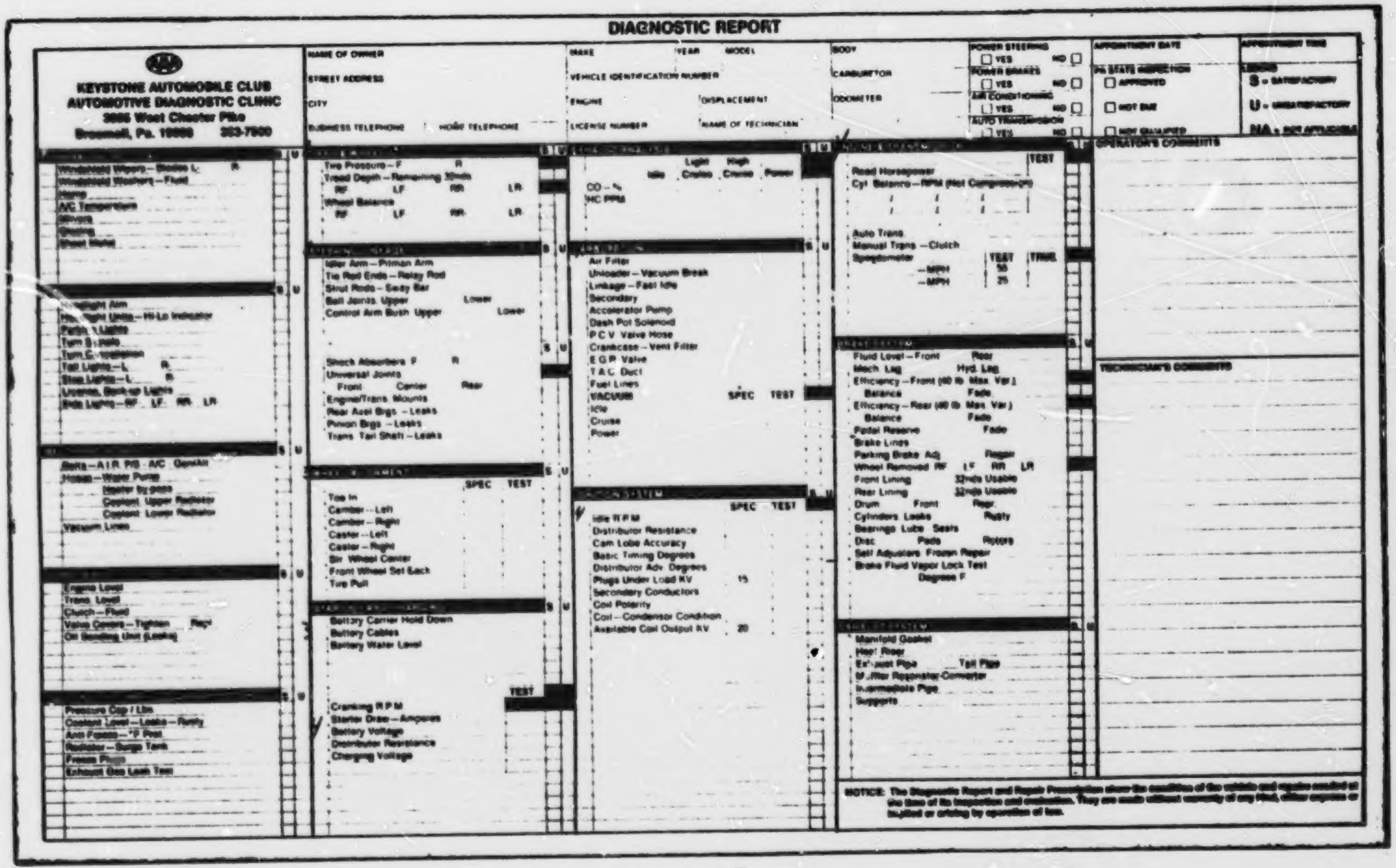
5. Safety Accommodations: Fire extinguishers are hung on the wall around the facility. Parabolic mirrors are positioned outside of the building in the parking lot to eliminate blind spots.

6. Noise Accommodations: The wall separating the inspection bays from the customer waiting lounge is a special acoustical wall with staggered studs and a sandwich of fiberglass in the center. The viewing window is made of thermopane glass. The dynamometer is equipped with sound deadening rolls.

III. STEPS OF INSPECTION PROCESS

1. Check-In: A senior technician conducts the pre-inspection interview with the customer to obtain comments about the operation of the car and any particular problems. The top part of the Diagnostic Report, shown in Figure 2, is completed with the vehicle make, year, model, VIN, engine size, odometer reading, and other basic data. The senior technician takes the keys and conducts the vehicle through the lane after the motorist is shown to the customer lounge and observing area.

2. Test Sequence: As many as two or three inspectors work on each car simultaneously; thus, several inspection procedures may be performed concurrently. The detailed checksheet is shown in Figure 2. The general sequence is described below.



DIAGNOSTIC REPORT

KEYSTONE AUTOMOBILE CLUB
AUTOMOTIVE DIAGNOSTIC CLINIC
3885 West Chester Pike
Broomall, Pa. 19008 353-7900

NAME OF OWNER
STREET ADDRESS
CITY
BUSINESS TELEPHONE HOME TELEPHONE

MAKE YEAR MODEL
VEHICLE IDENTIFICATION NUMBER
ENGINE DISPLACEMENT
LICENSE NUMBER NAME OF TECHNICIAN

BODY
CARBURETOR
ODOMETER

POWER STEERING ☐ YES NO ☐
POWER BRAKES ☐ YES NO ☐
AIR CONDITIONING ☐ YES NO ☐
AUTO TRANSMISSION ☐ YES NO ☐

APPOINTMENT DATE
PA STATE INSPECTION
☐ APPROVED
☐ NOT DUE
☐ NOT QUALIFIED

APPOINTMENT TIME
LEGEND
S = SATISFACTORY
U = UNSATISFACTORY
NA = NOT APPLICABLE

S U
Windshield Wipers—Blades L R
Windshield Washers—Fluid
Horns
A/C Temperature
Mirrors
Glazing
Sheet Metal

S U
Headlight Aim
Headlight Units—Hi-Lo Indicator
Parking Lights
Turn Signals
Turn Cancellation
Tail Lights—L R
Stop Lights—L R
License, Back-up Lights
Side Lights—RF LF RR LR

S U
Belts—A.I.R. P/S A/C Gen/Alt
Hoses—Water Pump
Heater by-pass
Coolant Upper Radiator
Coolant Lower Radiator
Vacuum Lines

S U
Engine Level
Trans. Level
Clutch—Fluid
Valve Covers—Tighten Repl
Oil Sending Unit (Leaks)

S U
Pressure Cap / Lbs
Coolant Level—Leaks—Rusty
Anti Freeze—°F Prot.
Radiator—Surge Tank
Freeze Plugs
Exhaust Gas Leak Test

S U
Tire Pressure—F R
Tread Depth—Remaining 32nds
RF LF RR LR
Wheel Balance
RF LF RR LR

S U
Idler Arm—Pitman Arm
Tie Rod Ends—Relay Rod
Strut Rods—Sway Bar
Ball Joints Upper Lower
Control Arm Bush Upper Lower

S U
Shock Absorbers F R
Universal Joints
Front Center Rear
Engine/Trans. Mounts
Rear Axel Brgs.—Leaks
Pinion Brgs.—Leaks
Trans. Tail Shaft—Leaks

S U
SPEC TEST
Toe In
Camber—Left
Camber—Right
Caster—Left
Caster—Right
Str. Wheel Center
Front Wheel Set Back
Tire Pull

S U
Battery Carrier Hold Down
Battery Cables
Battery Water Level

TEST
Cranking R P M
Starter Draw—Amperes
Battery Voltage
Distributor Resistance
Charging Voltage

S U
Light High
Idle Cruise Cruise Power
CO—%
HC PPM

S U
Air Filter
Unloader—Vacuum Break
Linkage—Fast Idle
Secondary
Accelerator Pump
Dash Pot Solenoid
P C V Valve Hose
Crankcase—Vent Filter
E G R Valve
T A C Duct
Fuel Lines
VACUUM SPEC TEST
Idle
Cruise
Power

S U
SPEC TEST
Idle R P M
Distributor Resistance
Cam Lobe Accuracy
Basic Timing Degrees
Distributor Adv. Degrees
Plugs Under Load KV 15
Secondary Conductors
Coil Polarity
Coil—Condensor Condition
Available Coil Output KV 20

S U
TEST
Road Horsepower
Cyl. Balance—RPM (Not Compression)
Auto Trans.
Manual Trans.—Clutch
Speedometer TEST TRUE
—MPH 50
—MPH 25

S U
Fluid Level—Front Rear
Mech. Lag Hyd. Lag
Efficiency—Front (40 lb. Max. Var.)
Balance Fade
Efficiency—Rear (40 lb. Max. Var.)
Balance Fade
Pedal Reserve Fade
Brake Lines
Parking Brake Adj. Repair
Wheel Removed RF LF RR LR
Front Lining 32nds Usable
Rear Lining 32nds Usable
Drum Front Rear
Cylinders Leaks Rusty
Bearings Lube Seals
Disc Pads Rotors
Self Adjusters Frozen Repair
Brake Fluid Vapor Lock Test
Degrees F

S U
Manifold Gasket
Heat Riser
Exhaust Pipe Tail Pipe
Muffler Resonator Converter
Intermediate Pipe
Supports

OPERATOR'S COMMENTS

TECHNICIAN'S COMMENTS

NOTICE: The Diagnostic Report and Repair Prescription show the condition of the vehicle and repairs needed at the time of its inspection and evaluation. They are made without warranty of any kind, either express or implied or arising by operation of law.

FIGURE 2. KEYSTONE AUTO CLINIC DIAGNOSTIC REPORT

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- Bay 1 - Vehicle on Hoist Over a Pit for Underbody Check*
  - General inspection including windshield wipers, windshield washers, horn, A/C temperature, mirrors, glazing and body condition.
  - Lights including hi-lo indicator, parking lights, turn signals, turn cancellation, tail lights, stop lights, back-up lights, side lights.
  - Check for leaks in valve cover and oil sending unit.
  - Tire pressure, tread depth, wheel balance.
  - Steering linkage check including idler arm, pitman arm, tie rod ends, relay rod, strut rods, sway bar, ball joints, control arm bushings, shock absorbers, universal joints, engine/transaxle mounts, rear axle bearings, pinion bearings and transaxle tail shaft.
  - Brake check including brake lines, parking brake and removal of two wheels to inspect linings, drums, cylinders, bearings, discs, pads, rotors, and self adjusters.
  - Exhaust system check including manifold gasket, heat riser, exhaust pipe, tail pipe, muffler resonator-converter, intermediate pipe and supports.
- Bay 3 - Dynamic Wheel Alignment and Headlight Aim
  (Note: All cars proceed to Bay 3 after Bay 1. See Figure 1.)
  - Headlight aim.
  - Belts and hoses including power steering, A/C, generator/alternator and air injection reactor belts, and water pump hose, heater by-pass hose, radiator coolant hoses and vacuum lines.

---

* As the vehicle moves through the inspection process the inspector records test results. Following the inspection the inspector moves to the technical reference area where he compares the test results with the manufacturer's recommended specifications.

[redacted]

- Lubricant Levels including engine oil, transmission fluid and clutch fluid.
- Cooling system including a check for pressure of radiator cap, coolant level, antifreeze degree of freezing, radiator-surge tank, freeze plugs and an exhaust gas leak test.
- Wheel alignment including toe-in, camber, caster, steering wheel center, front wheel set-back and tire pull (see Figure 3 for explanation).
- Starting and charging including battery carrier hold down, battery cables, battery water level.
- Miscellaneous underhood checks including PCV valve hose, EGR valve.
- Brake fluid including fluid level and a brake fluid vapor lock test (see Figure 4 for explanation).

- Bay 4 - Combination Brake-Chassis Dynamometer and Engine Analyzer
  - Starting and charging including cranking rpm, starter draw-in amperes, battery voltage, distributor resistance*, charging voltage.
  - Exhaust analysis including HC and CO at idle, lo-cruise, hi-cruise and wide-open throttle.
  - Carburetion including air filter, unloader-vacuum break, linkage at fast idle, secondary, accelerator pump, dash pot-solenoid, crankcase-vent filter, temperature air control duct, fuel lines, vacuum at idle, cruise and wide-open throttle.
  - Ignition system including idle rpm, distributor resistance*, cam lobe accuracy, basic timing degrees and other ignition items (see Figure 2 for complete list).

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* Either point resistance or pick-up coil resistance (for vehicles with electronic ignition).

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During the course of evaluating your automobile, it has been determined that an unacceptable amount of "TIRE PULL" exists. This is also sometimes called "LATERAL TIRE FORCE", and may be found in all sizes, makes and grades of tires.

Simply defined, tire pull is the tendency of a tire to pull to the right or left, due to the construction of the tire itself.

It has not yet been determined exactly what all of the factors are which cause tire pull, as it may also be found in brand new tires. The effect of tire pull is measure in an equivalent number of feet per mile that the tire will deviate in a sideways direction.

Unstable steering that results from tire pull may be minimized by switching the spare or a rear tire with the offending tire. Ordinarily, changes in steering geometry or wheel alignment should not be made to compensate for tire pull.

Most tire companies are aware of tire pull, and have sometimes replaced tires which are creating driving problems.

FIGURE 3. EXPLANATION OF "TIRE PULL" INSPECTION PROVIDED TO ALL KEYSTONE CUSTOMERS

During the course of the Diagnostic Evaluation of your automobile, it has been determined that your brake fluid has tested poorly in our "Vapor Lock" test of your hydraulic brake fluid.

All mineral or polyglycol brake fluids are "hygroscopic". That is, they readily absorb moisture from the air. Over a period of time, brake fluids can absorb enough moisture to severely reduce the temperature at which the fluid "boils", or turns to a vapor. When this occurs, braking action is lost until the fluid cools and condenses back into a liquid.

The brake components of automobiles used in stop and go driving or in mountain driving will frequently exceed 155° Centigrade or 311° Fahrenheit. If the brake fluid has acquired enough moisture to cause a small amount of the fluid to boil or vaporize, braking action will be lost! Further, excessive moisture content in the brake fluid contributes to accelerated corrosion of many of the metal components in the brake system.

When brake fluid replacement is called for, the replacement fluid should come from a fresh can of fluid that has a metal seal intact in the top of the can. Also, be certain the replacement fluid conforms to the DOT specification called for by the automobile manufacturer.

FIGURE 4. EXPLANATION OF "BRAKE FLUID VAPOR LOCK" TEST PROVIDED TO ALL KEYSTONE CUSTOMERS

- Engine and transmission including road horsepower, cylinder balance and rpm, automatic transmission, manual transmission and clutch, and speedometer accuracy.

- Brake system including mechanical lag*, hydraulic lag*, brake efficiency and balance, pedal reserve and fade.**

- Bay 2 - Subsystem or Rechecks

  This bay is used for more in-depth diagnosis of trouble areas when requested by the customer.

3. Data Handling: Currently all inspection data is collected manually on the Diagnostic Report (Figure 2), a copy of which is filed at the center. In the future the center hopes to keypunch the data for statistical analysis. The customer receives a copy of the Diagnostic Report and a special Repair Prescription form which itemizes the recommended repairs in simple language.

4. Check-Out: The same senior technician who performed the pre-inspection interview counsels the customer at the conclusion of the diagnostic inspection. All recommended repair actions are stated separately on a Repair Prescription form as shown in Figure 5. The customer is advised to show the prescription form to the repair facility but not the Diagnostic Report (too technical for most repair mechanics). Customer counseling is conducted at a separate counseling counter (customer and technician stand during counseling to minimize the length of the discussions). A small sticker, shown in Figure 6, is attached to the car following the diagnostic check.

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* Diagnosis of mechanical and hydraulic brake lag is performed at Keystone by experienced senior automotive technicians who hold NIASE certification in Brakes. When lag is thus reliably detected in a vehicle, the vehicle owner should be advised to have the source of the lag examined via wheel pull.

** Keystone inspectors look for inconsistent brake fade between two wheels on the same axle. If the fade is substantially different, the motorist is advised to have the brakes examined for possible thin linings, a leaking wheel cylinder or other problem. If a vehicle passes a fade test it does not mean that the vehicle will not experience fade under severe conditions. Also, evidence of brake fade may not necessarily be the result of thin or contaminated linings but merely a variation in the friction coefficient of different lining materials. Thus, inspectors should not arbitrarily recommend replacement of brake linings since such an action could result in unnecessary repairs.

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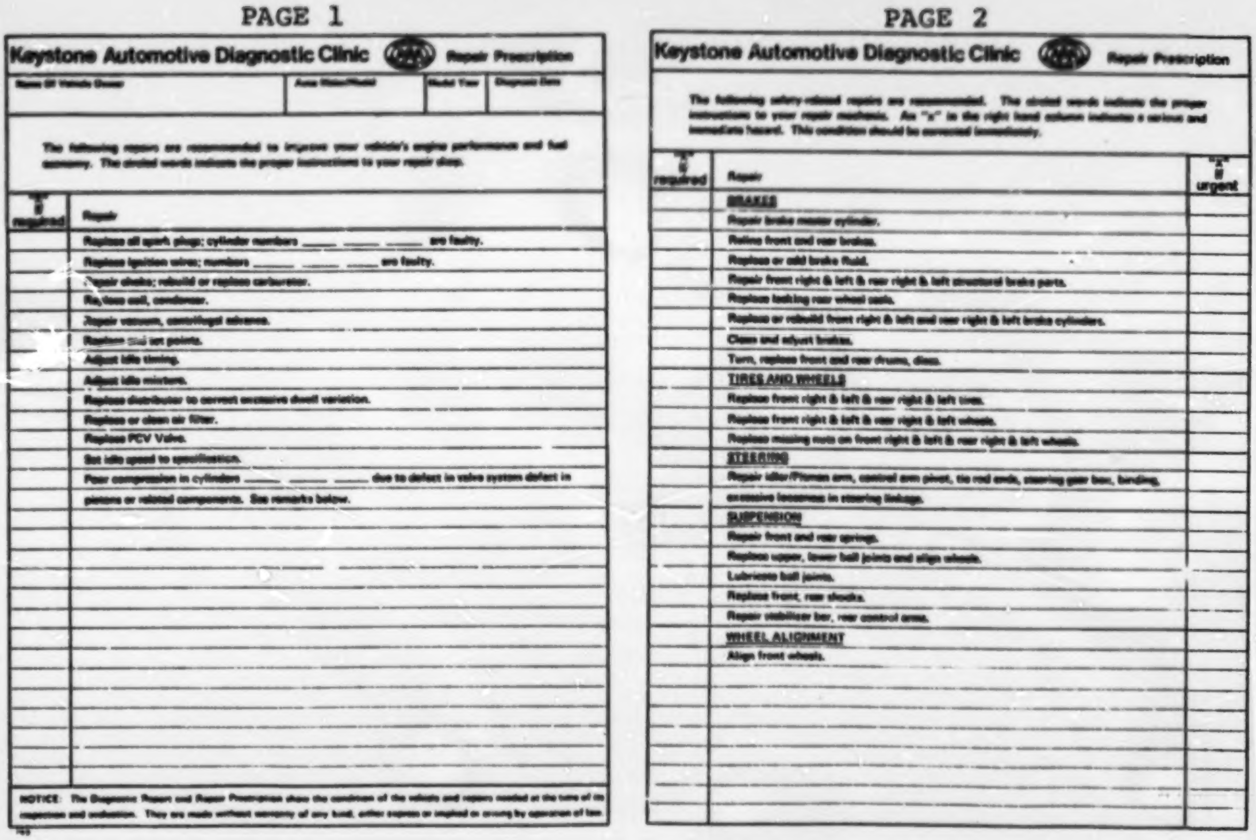


PAGE 1

Keystone Automotive Diagnostic Clinic Repair Prescription

Name Of Vehicle Owner	Auto Make/Model	Model Year	Diagnosis Date

The following repairs are recommended to improve your vehicle's engine performance and fuel economy. The circled words indicate the proper instructions to your repair shop.

"X" if required	Repair
	Replace all spark plugs; cylinder numbers _____ _____ _____ are faulty.
	Replace ignition wires; numbers _____ _____ _____ are faulty.
	Repair choke; rebuild or replace carburetor.
	Replace coil, condenser.
	Repair vacuum, centrifugal advance.
	Replace and set points.
	Adjust idle timing.
	Adjust idle mixture.
	Replace distributor to correct excessive dwell variation.
	Replace or clean air filter.
	Replace PCV Valve.
	Set idle speed to specification.
	Poor compression in cylinders _____ _____ _____ due to defect in valve system defect in
	pistons or related components. See remarks below.

NOTICE: The Diagnostic Report and Repair Prescription show the condition of the vehicle and repairs needed at the time of its inspection and evaluation. They are made without warranty of any kind, either express or implied or arising by operation of law.

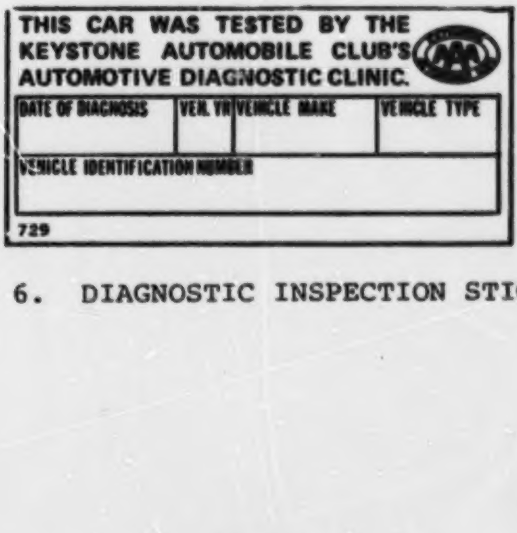
PAGE 2

Keystone Automotive Diagnostic Clinic Repair Prescription

The following safety-related repairs are recommended. The circled words indicate the proper instructions to your repair mechanic. An "x" in the right hand column indicates a serious and immediate hazard. This condition should be corrected immediately.

"X" if required	Repair	"X" if urgent
	BRAKES	
	Repair brake master cylinder.	
	Reline front and rear brakes.	
	Replace or add brake fluid.	
	Repair front right & left & rear right & left structural brake parts.	
	Replace leaking rear wheel seals.	
	Replace or rebuild front right & left and rear right & left brake cylinders.	
	Clean and adjust brakes.	
	Turn, replace front and rear drums, discs.	
	TIRES AND WHEELS	
	Replace front right & left & rear right & left tires.	
	Replace front right & left & rear right & left wheels.	
	Replace missing nuts on front right & left & rear right & left wheels.	
	STEERING	
	Repair idler/Pitman arm, control arm pivot, tie rod ends, steering gear box, binding,	
	excessive looseness in steering linkage.	
	SUSPENSION	
	Repair front and rear springs.	
	Replace upper, lower ball joints and align wheels.	
	Lubricate ball joints.	
	Replace front, rear shocks.	
	Repair stabilizer bar, rear control arms.	
	WHEEL ALIGNMENT	
	Align front wheels.	

FIGURE 5. KEYSTONE AUTO CLINIC REPAIR PRESCRIPTION



THIS CAR WAS TESTED BY THE KEYSTONE AUTOMOBILE CLUB'S AUTOMOTIVE DIAGNOSTIC CLINIC.

DATE OF DIAGNOSIS	VEH. YR	VEHICLE MAKE	VEHICLE TYPE

VEHICLE IDENTIFICATION NUMBER

729

FIGURE 6. DIAGNOSTIC INSPECTION STICKER

IV. FEES

1. Diagnostic Inspection: Member - $30.00
   Nonmembers - $40.00
   (Vans are charged $5.00 extra).

2. Other Services: Recheck - $5.00
   Subsystem checks are charged at a rate of $30.00 per hour.

V. TEST EQUIPMENT

All equipment is newly purchased and installed in the diagnostic center. The selection of equipment was based on reliability and speed of operation.

1. Brakes: (One) Clayton Flywheel DB8CP-200 Brake Tester and Dynamometer ($38,000).

2. Alignment: (One) Hunter F-70 D Front End Analyzer ($45,000).

3. Headlight Aim: (One) Hunter Optical Headlight Aimer.

4. Lift: (One) Hunter Diagnostic Rack ($6,000). Lift goes to 36" height only. Underbody check is performed with inspector standing in a pit.

5. Emission Analyzer: Part of Sun engine analyzers.

6. Engine Analyzer: (One) Sun Computer II-1215 ($17,000), (One) Sun Engine Analyzer 947 ($6,000).

7. Dynamometer: See brakes.

8. Noise Testing: Test for bearing noise by placing a Snap-on bearing stethescope against the car metal. No test for muffler noise is performed.

9. Fuel Economy: A flow meter technique for checking fuel consumption is being developed. The procedure will take approximately 20 minutes and will involve placing a highway load (8 hp) on the car and installing a fuel flow meter to measure consumption in thousandths of gallons for approximately five miles. The procedure will involve disconnecting the fuel lines and will only be performed when there is a strong complaint of low fuel mileage.

10. Other: Keystone is currently satisfied with all its test equipment.

11. Plans for Replacement: None.

12. Technical Library: The technical library is prominently housed in a bookcase positioned against a wall in Bay 1. The three shelves contain up-to-date Mitchell manuals on all vehicle make/model specifications.

13. Mobile Equipment: None.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: As needed. All of the equipment is brand new. Manufacturers' representatives from Clayton, Hunter and Sun come in periodically to check the equipment. During the first couple of months the equipment will be maintained every 30 days. After that time, the manufacturers' representatives will visit every 90 days. After the first six months, the equipment will be maintained every 180 days. Since all the equipment is new, the director is going to experiment with calibration schedules to see what is required and whether the center staff can perform all needed calibrations.

2. Frequency of Gas Calibration for Emission Analyzer: The analyzers are electronically calibrated daily. Gas calibration will initially be performed every 30 days. Since the center is equipped with two engine analyzers, they are cross-calibrated to check for improper adjustment.

VII. FACILITY STAFFING

The Diagnostic Center has one director and nine staff members.

1. Program Director*: Jack E. Weber, Jr.

2. Station Manager: Everett Wright.

3. Supervisor (Inspector): One.

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* Position titles are official titles as defined by Keystone.

4. Senior Technician (Inspector): Two.

5. Technician (Inspector): One.

6. Junior Technician (Inspector): Three.

7. Clerical: 1 Receptionist/Appointment Scheduler.

8. Other: None.

VIII. TRAINING

1. Inspector Experience Requirements: Requirements vary by position. The manager and supervisor must be NIASE certified in all areas (Certified General Auto Mechanic—CGAM). Senior technicians must have certification or be working towards certification in six areas. Junior technicians must, as a stipulation of employment, start working towards certification. The center has developed its own entrance tests for junior technicians, while more senior inspectors must have automotive repair knowledge and experience. The center interviewed 45 applicants to select six staff members.

2. Employee Training Provisions: Continuous on-the-job training of technicians is provided by the station supervisor and manager. Instruction on the Clayton and Hunter equipment is provided by the manufacturers. The station manager, formerly an employee of Sun, provides training on the Sun Engine analyzers. Keystone Auto Club operates a formal training program to prepare mechanics for NIASE certification tests, including classroom and lab sessions.

3. Technical Update Meetings: Meetings are held once a week and last one to two hours. Topics include unusual testing problems, testing procedures and other technical update information.

IX. QUALITY CONTROL

1. Supervision for Inspectors: The station manager supervises the lane supervisor. They both check on the work of the senior technicians. The senior technicians guide the junior technicians.

2. Surveys of Customer Satisfaction: Since the facility is new, no surveys have been conducted to date. The facility has received a strong response from the public. All appointment times are fully scheduled Three months in advance.

3. Criteria for Failure: Manufacturers' standards for engine adjustment and Pennsylvania standards for safety components are used. The Auto Club depends on inspector judgment in areas with unwritten standards such as:

- Tire Pull - Typically, if a car has more than 20 feet per mile of tire pull it is rated unsatisfactory.*
- Brake Performance - Typically, if a car has a difference in braking effort from one wheel to the other of 40 pounds or more, it is rated unsatisfactory.**
- Miscellaneous Specifications: An inspector might make a comment to the customer such as, "You have a leading or lagging brake and a probable explanation is...; it should be checked out." Diagnoses such as this may be based on the inspector's experience.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Reinspections are conducted in the recheck area of Bay 2. A fee of $5.00 is charged. Motorists desiring a recheck must return the vehicle to the diagnostic center within ten days following repairs.

XI. CUSTOMER INTERFACE

1. Counseling: Counseling is provided by the same supervisor and senior technicians who perform the pre-inspection interview, analyze the diagnostic results, write the repair prescription and review the results with the customer. No repair cost estimates or recommendations of specific garages are provided. The repair prescription states needed work in simple, concise terms that can be understood by the garage.

---

* There is no industry standard for tire pull.

** Federal vehicle-in-use standards specify that a side-to-side brake force difference should not exceed 20 percent. Some sources believe that consistent application of less tolerant standards could lead to unnecessary repair.

[redacted]

2. Additional Customer Services: Information sheets are provided on tire pull and brake fluid vapor lock tests. These information sheets are for the benefit of the motorist and the repair facility. Samples are shown in Figures 3 and 4.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: Currently one hour including counseling. The theoretical processing time per vehicle is 45 minutes.

2. Time at Each Inspection Station:

   - Bay 1: Underbody check and wheel pull 12 minutes

   - Bay 3: Front-end alignment, headlight aim 12 minutes

   - Bay 4: Dynamic brake tests and engine analysis 15 minutes.

3. Theoretical Maximum Throughput: 40 cars per day. This throughput has not been achieved. Time studies have identified the dynamometer (Bay 4) as the biggest problem in throughput. New cars can be tested fairly quickly, but older cars with problems such as vacuum leaks tend to slow up the process.

4. Average Throughput: 32-35 cars per day. The station is averaging 3.8 cars per technician per day.

5. Appointments Used: Yes. In addition to scheduled appointments, about six stand-by appointments are scheduled each day to provide fill-in for no-shows. Motorists with scheduled appointments receive a reminder card, shown in Figure 7, approximately a week in advance and a telephone call on the day before the appointment.

6. Busiest Time of Year: The center has just opened and is totally booked for the next three months.

7. Maximum Number of Vehicles Processed per Hour for the Entire Facility: Theoretical maximum is five cars per hour.

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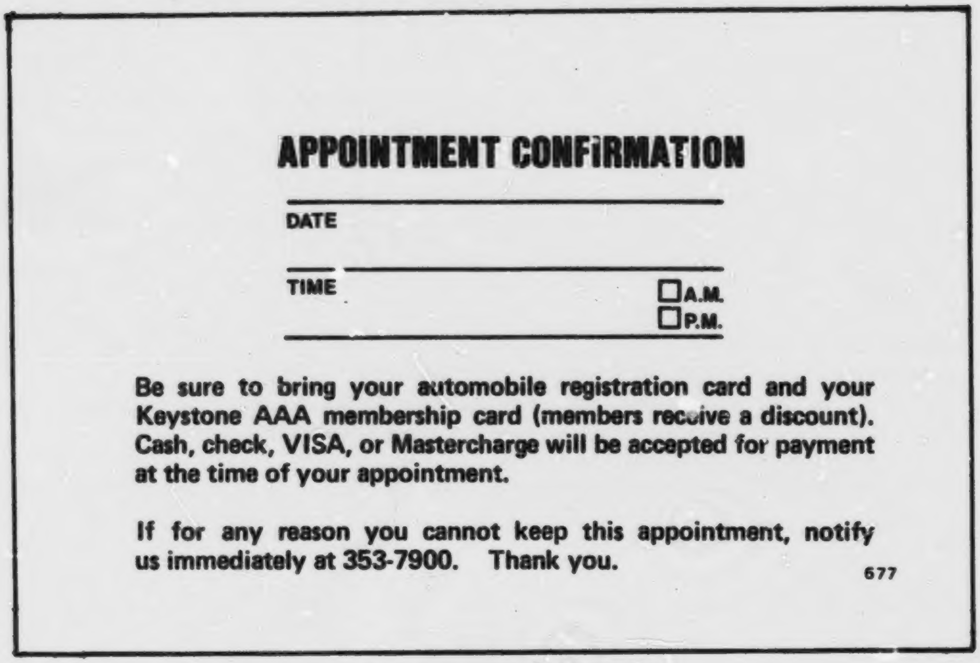


APPOINTMENT CONFIRMATION

DATE

TIME ☐ A.M.
☐ P.M.

Be sure to bring your automobile registration card and your Keystone AAA membership card (members receive a discount). Cash, check, VISA, or Mastercharge will be accepted for payment at the time of your appointment.

If for any reason you cannot keep this appointment, notify us immediately at 353-7900. Thank you.

677

FIGURE 7. APPOINTMENT REMINDER CARD

XIII. CONSUMER AND COMMUNITY RELATIONS

The Keystone Auto Club has been conducting evening orientation seminars for members of the repair industry to familiarize them with the diagnostic center operations.

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment:

Building Construction:	$325,000
Equipment:	200,000
Land:	225,000
Total	$750,000 (1979-80)

2. Current Average Hourly Labor Rate: Customers pay for additional subsystem diagnosis at a rate of $30.00 per hour. Wage rates for inspectors are:

- Junior Technician ($200/week)-$5.00/hr.
- Technician ($265/week)-$6.63/hr.
- Senior Technician ($300/week)-$7.50/hr.

3. Operating Budget:

$200,000/year.

AUTO CLUB CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: Auto Club of Missouri
Diagnostic Clinic
3925 Lindell Boulevard
St. Louis, Missouri 63108

2. Contact Name and Phone Number: Fran Oldham
Director of Technical Services

Wayne Young
Diagnostic Clinic Manager
(314) 533-6550

3. General Description of Facility: The St. Louis Diagnostic Clinic is one of the two diagnostic centers affiliated with the Automobile Club of Missouri. The St. Louis Clinic opened in October 1967, the first private facility in the United States to offer diagnostic inspection of motor vehicles.

With a building area of 8,400 square feet, the St. Louis Clinic is one of the largest Auto Club diagnostic centers in the United States. The facility contains eight bays which hold six lifts, two lanes and an observation area for customers.

The clinic inspects vehicles of both members and non-members of the Automobile Club of Missouri. Members are given a 25 percent discount on diagnostic services.

4. Vehicle Types Inspected: All passenger cars, and trucks smaller than 3/4 ton. Vans are charged extra unless the driver removes the engine cover.

5. Types of Inspection Services: The clinic offers four types of inspection:

- A complete inspection-"main lane"
- System/component inspection-"bay"
- Periodic vehicle inspection-"state"
- Post-repair inspection-"recheck".

Repairs are not performed. The attached brochure provides a list of services offered by the clinic (see Figure 1).

6. Hours of Operation: M-F 8:00 a.m. to 5:00 p.m.

7. Physical Area of Inspection Facility: The building itself covers 8,400 square feet.

8. Inspection Station Dimensions: The inspection station dimensions are 140' x 60'.

9. Number of Lanes/Bays: The center contains two lanes plus eight bays equipped with six lifts. Two bays do not have lifts.

10. Lane/Bay Dimensions: The bays are 35 feet deep by 12 feet wide. The total bay area is 120 feet wide. The lane extends the length of the facility (140 feet), then makes an L-shaped turn and continues along the right side of the facility. The second lane is shorter, approximately 60 feet long.

11. Queueing Area: None is required because vehicles arrive by appointment.

12. Parking Area: The parking area can accommodate 45-50 cars.

13. Facility Diagram and Location of Equipment: A diagram of the facility is shown in Figure 2.

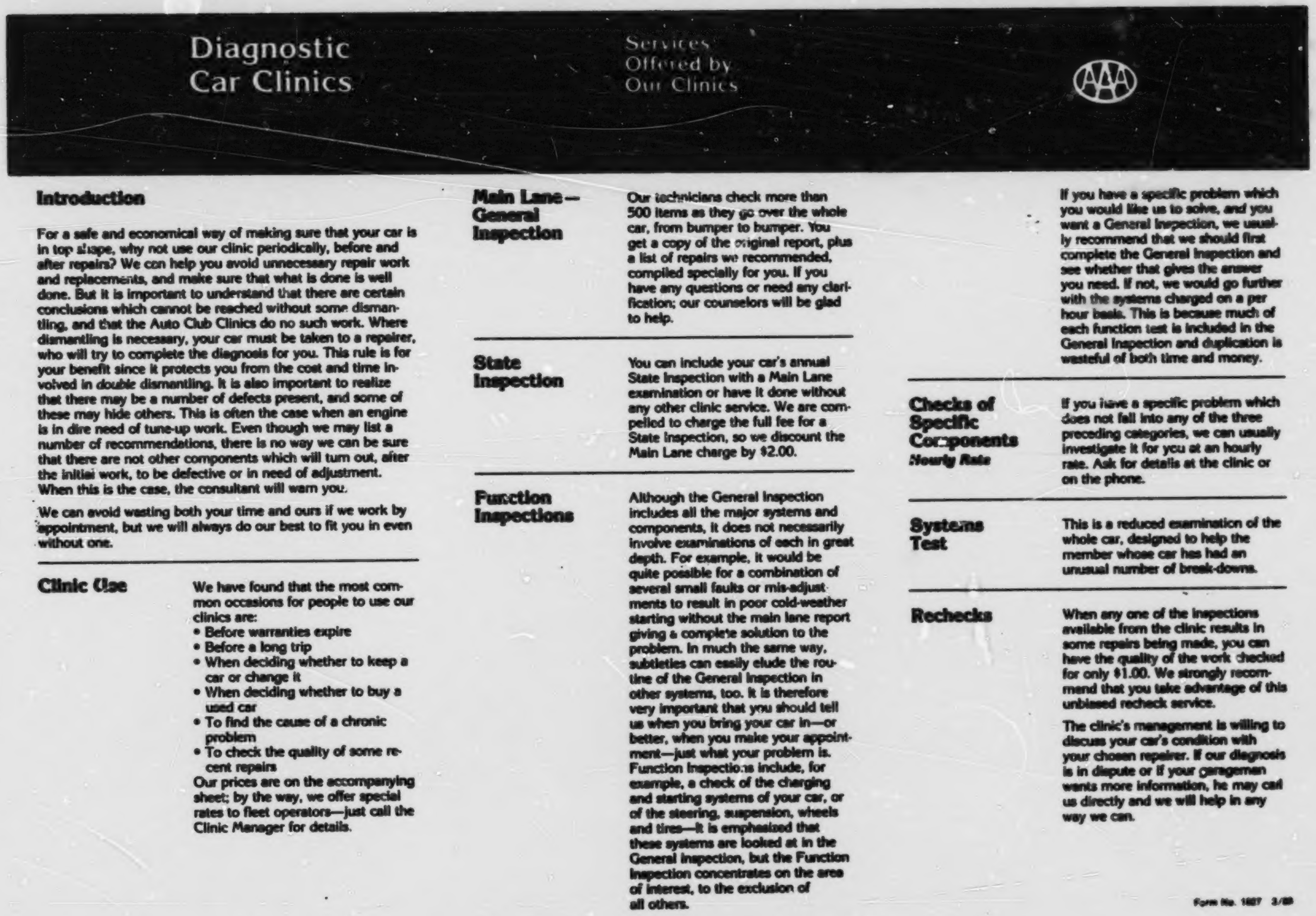
II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Built: 1967

2. Construction Type & Material: Cement block, glass and concrete.

3. Patron Accommodations in Addition to Lanes: The customers can observe the inspection process from the observation area from which it is separated by safety glass. The observation area is located between the dynamometer lane and Bay 1. The walkway follows along the dynamometer lane, then turns to the right past the counseling area, rest rooms, locker room and offices.

4. Ventilation System Design: Individual exhaust blowers are installed at each dynamometer. The blowers are supplemented by 3" diameter stainless steel flexible ducting.



Diagnostic Car Clinics

Services Offered by Our Clinics

AAA

Introduction

For a safe and economical way of making sure that your car is in top shape, why not use our clinic periodically, before and after repairs? We can help you avoid unnecessary repair work and replacements, and make sure that what is done is well done. But it is important to understand that there are certain conclusions which cannot be reached without some dismantling, and that the Auto Club Clinics do no such work. Where dismantling is necessary, your car must be taken to a repairer, who will try to complete the diagnosis for you. This rule is for your benefit since it protects you from the cost and time involved in *double* dismantling. It is also important to realize that there may be a number of defects present, and some of these may hide others. This is often the case when an engine is in dire need of tune-up work. Even though we may list a number of recommendations, there is no way we can be sure that there are not other components which will turn out, after the initial work, to be defective or in need of adjustment. When this is the case, the consultant will warn you.

We can avoid wasting both your time and ours if we work by appointment, but we will always do our best to fit you in even without one.

Clinic Use

We have found that the most common occasions for people to use our clinics are:

- Before warranties expire
- Before a long trip
- When deciding whether to keep a car or change it
- When deciding whether to buy a used car
- To find the cause of a chronic problem
- To check the quality of some recent repairs

Our prices are on the accompanying sheet; by the way, we offer special rates to fleet operators—just call the Clinic Manager for details.

Main Lane— General Inspection

Our technicians check more than 500 items as they go over the whole car, from bumper to bumper. You get a copy of the original report, plus a list of repairs we recommended, compiled specially for you. If you have any questions or need any clarification; our counselors will be glad to help.

State Inspection

You can include your car's annual State Inspection with a Main Lane examination or have it done without any other clinic service. We are compelled to charge the full fee for a State Inspection, so we discount the Main Lane charge by $2.00.

Function Inspections

Although the General Inspection includes all the major systems and components, it does not necessarily involve examinations of each in great depth. For example, it would be quite possible for a combination of several small faults or mis-adjustments to result in poor cold-weather starting without the main lane report giving a complete solution to the problem. In much the same way, subtleties can easily elude the routine of the General Inspection in other systems, too. It is therefore very important that you should tell us when you bring your car in—or better, when you make your appointment—just what your problem is. Function Inspections include, for example, a check of the charging and starting systems of your car, or of the steering, suspension, wheels and tires—it is emphasized that these systems are looked at in the General Inspection, but the Function Inspection concentrates on the area of interest, to the exclusion of all others.

If you have a specific problem which you would like us to solve, and you want a General Inspection, we usually recommend that we should first complete the General Inspection and see whether that gives the answer you need. If not, we would go further with the systems charged on a per hour basis. This is because much of each function test is included in the General Inspection and duplication is wasteful of both time and money.

Checks of Specific Components

Hourly Rate

If you have a specific problem which does not fall into any of the three preceding categories, we can usually investigate it for you at an hourly rate. Ask for details at the clinic or on the phone.

Systems Test

This is a reduced examination of the whole car, designed to help the member whose car has had an unusual number of break-downs.

Rechecks

When any one of the inspections available from the clinic results in some repairs being made, you can have the quality of the work checked for only $1.00. We strongly recommend that you take advantage of this unbiased recheck service.

The clinic's management is willing to discuss your car's condition with your chosen repairer. If our diagnosis is in dispute or if your garageman wants more information, he may call us directly and we will help in any way we can.

Form No. [illegible]

BEST DOCUMENT AVAILABLE

FIGURE 1. BROCHURE LISTING SERVICES OF THE AUTO CLUB OF MISSOURI

BEST DOCUMENT AVAILABLE

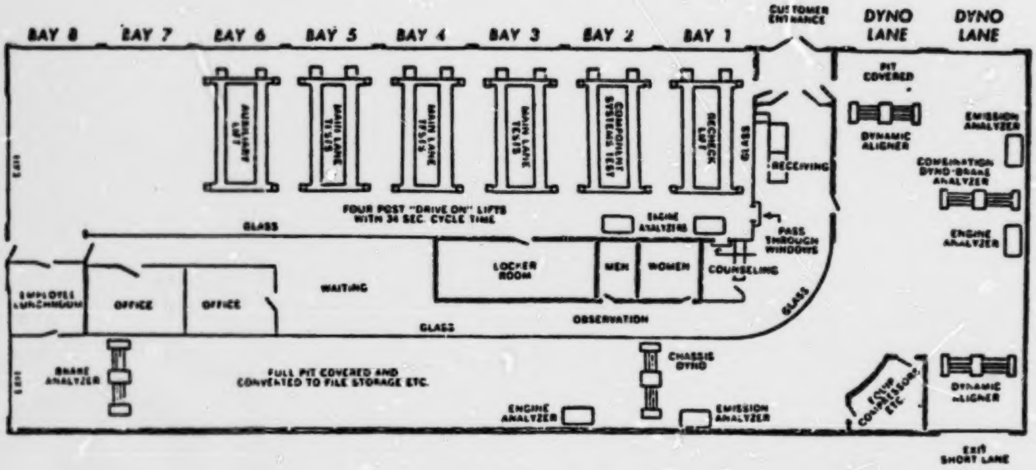

BAY 8
BAY 7
BAY 6
BAY 5
BAY 4
BAY 3
BAY 2
BAY 1
CUSTOMER ENTRANCE
DYNO LANE
DYNO LANE
EXIT
AUXILIARY LIFT
MAIN LANE TESTS
MAIN LANE TESTS
MAIN LANE TESTS
COMPONENT SYSTEMS TEST
RECHECK LIFT
GLASS
RECEIVING
PIT COVERED
DYNAMIC ALIGNER
EMISSION ANALYZER
COMBINATION DYNO-BRAKE ANALYZER
ENGINE ANALYZER
FOUR POST "DRIVE ON" LIFTS WITH 34 SEC. CYCLE TIME
GLASS
ENGINE ANALYZERS
PASS THROUGH WINDOWS
EMPLOYEE LUNCHROOM
OFFICE
OFFICE
WAITING
LOCKER ROOM
MEN
WOMEN
COUNSELING
GLASS
OBSERVATION
GLASS
EXIT
BRAKE ANALYZER
FULL PIT COVERED AND CONVERTED TO FILE STORAGE ETC.
CHASSIS DYNO
ENGINE ANALYZER
EMISSION ANALYZER
EQUIP. COMPRESSORS ETC.
DYNAMIC ALIGNER
EXIT SHORT LANE

FIGURE 2. DIAGRAM OF AUTO CLUB OF MISSOURI DIAGNOSTIC CLINIC, ST. LOUIS, MISSOURI

5. Safety Accommodations: The St. Louis clinic utilizes a number of safety devices and special accommodations including the following:

- Safety glass surrounds the patron viewing area.
- CO alarms (manufactured by Mine Safety Appliances) are installed in the diagnostic lane.
- Regulation nozzles are used on the compressed air hoses.
- Protective masks (molded Lexan plastic) are worn by the inspectors when they check the ignition timing at 2,500 rpm on the dynamometer, to protect against any moving parts that may fly off the engine.
- Goggles are available for the inspectors when using freon or compressed air to protect their eyes from freezing gas or dirt carried by the compressed air.
- A large sheet (2' x 3') of Lexan plastic is occasionally placed over an engine while the car is on the dynamometer if it is suspected that the fan has a loose component.

6. Noise Accommodations: As part of the sound reduction program, sound deadening rolls have been installed on the dynamometers. Ceiling and wall treatments have reduced the sound to a level below OSHA regulations. The ceiling area in the lanes and bays is dotted with foam rubber pads covered with a black flame-retardant material. These pads are suspended from the ceiling approximately every 2 feet and act as noise baffles. The walls are covered with white fiberboard.

III. STEPS OF INSPECTION PROCESS

1. Check-In: The customer enters the reception area and is interviewed by the service scheduler. Identifying information on the motorist, the car and any symptoms of the vehicle are recorded on the customer entrance form, shown in Figure 3. The service scheduler then hands the form over to the technicians and the customer goes to the waiting area while the inspection is performed.

2. Test Sequence: The diagnostic clinic inspects more than 500 items during the "main lane" inspection. These items are listed on the inspection sheet shown in Figure 4. The inspection sequence is as follows:*

   - Operator equipment (horn, wipers, etc.) is checked in the parking lot (items 1-4 and 11 on checksheet in Figure 4).
   - Vehicle enters bay and is raised on the lift. The lights are checked (items 5-10) and several fluid levels and engine checks are made while the engine is running (items 12, 13 and 46).
   - Still on the lift, the vehicle is checked while the engine is turned off. Power steering and the battery are checked (items 14-29).
   - The wheels are pulled to check the brakes, and the tires are checked (items 55-72, 100).
   - The fuel and exhaust systems, steering, suspension and chassis are checked (items 73-85, 88-99).
   - The vehicle is checked for engine leaks and transmission leaks (items 101-102).
   - The car is moved from the bay to the lane and the front wheel alignment is tested on the Hunter dynamic alignment tester (items 86-87).

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* Performance criteria are published in a reference manual for the inspectors (see page A-41).

[redacted]

- The engine performance is checked while the car is on the dynamometer (items 30-45).

- The brakes are tested on the dynamic brake tester (items 47-54).

3. Data Handling: During the inspection, the technicians fill out the Main Lane Diagnosis sheet (Figure 4) or other appropriate checksheet. For inspection of specific subsystems, functional checksheets are used. Figures 5 through 11 show seven separate inspection forms used at the St. Louis Clinic as follows:

   - Figure 5 - Engine Performance Checklist
   - Figure 6 - Cylinder Leakage and Compression Test Checklist
   - Figure 7 - Cranking and Charging Systems Checklist
   - Figure 8 - Steering, Suspension, Tire Checklist
   - Figure 9 - Cooling System Checklist
   - Figure 10 - Brakes and Tires Checklist
   - Figure 11 - Air Conditioning Checklist.

   All of the data is collected manually, and individual files are maintained for each customer. The data is not keypunched or computer analyzed.

4. Check-Out: Following the inspection, the counselor reviews the inspection checklist results and dictates a list of recommended repair instructions. These instructions are typed on the Repair Instructions form shown in Figure 12. The counselor then gives the customer a copy of the repair instruction sheet and the completed inspection checklist (Figure 13). If the customer requests further explanation, the counselor will review the results and explain the repair requirements. This counseling is performed in a separate counseling area.

5. Comments: The clinic is located downtown in a marginal neighborhood. Long-term plans of the Auto Club are to open up satellite facilities closer to the suburbs. Also, the lane layout is not completely efficient for diagnostic purposes. The Director of Technical Services would prefer

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to see new facilities arranged in a bay-type layout where all or most services could be performed with the vehicle in one place.* With the current lane arrangement, examination of a specific problem in the lane tends to reduce throughput.

IV. FEES

1. Diagnostic Inspection: (As of August 1980) the main lane full diagnostic inspection fees are:

- $30.00 members
- $40.00 non-members.

2. Other Services: A list of fees as of August 1980, is shown below:

	Member	*Non-Member*
Main Lane—General Inspection	$30.00	$40.00
Missouri State Inspection*	4.50	4.50
General Inspection and State Inspection	32.50	42.50
Systems Test	15.00	N.A.
Function Tests *(without General Inspection)*		
1. Cranking and charging	10.00	13.00
2. Starting and running (inc. 1)	15.00	20.00
3. Engine performance	20.00	27.00
4. Brakes and tires—2 wheels pulled	12.00	16.00
Brakes and tires—4 wheels pulled	17.00	22.00
5. Steering, suspension and tires	12.00	16.00
6. Cooling system without scope	10.00	13.00
Cooling system with scope	15.00	20.00
7. Air conditioning system	14.00	18.00
8. Cylinder leak test, per cylinder*	2.50	3.25
9. Speedo check	5.00	8.00
Component examination (in bays) per hour	25.00	35.00
Recheck		
• with receipts and within 30 days	1.00	1.00
• without receipts and between 30 and 60 days	6.50	6.50
*Not eligible for $1.00 or $6.50 recheck; rechecks for State Inspection defects after repair are free; rechecks of repairs after cylinder leak tests are charged as for initial tests—at per cylinder	2.50	3.25

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* This would probably require a somewhat greater investment in test equipment, although this can be alleviated to some degree by sharing major equipment/instrumentation with adjacent bays.

V. TEST EQUIPMENT

1. **Brakes**: (1) Clayton brake analyzer and (1) Clayton B8-CP200 Combination Dynamometer and brake analyzer

2. **Alignment**: (2) Hunter F-60 Dynamic Wheel Alignment Testers.

3. **Headlight Aim**: Only proper headlamp function is checked. No headlamp aiming equipment is used.

4. **Lifts**: (3) Alemite lifts and (3) Lincoln Lifts (with modifications by the Auto Club of Missouri to increase efficiency).

   Jacks: (10) Beissbarth air jacks.

5. **Emissions Analyzers**: (2) Horiba Model GSM 33 and (1) MSA (Lira).

6. **Engine Analyzers**: (2) Autoscan 4050, (1) Autoscan 4030, (1) Sun TUT-1015), (1) Sun 947.

7. **Dynamometer**: (1) Clayton CP200 chassis dynamometer. (Also, see Brakes, item 1.)

8. **Noise Testing**: (1) Bruel and Kjaer 2250 sound level meter and (1) General Radio Strobotac 1531.

9. **Fuel Economy**: (1) Systems Corporation Fuel Odometer.

10. **Other**:

    - (20) Snap-on battery and anti-freeze hydrometers
    - (10) Snap-on circuit testers
    - (10) Hunter rack-mounted wheel spinners
    - (1) Sun mdt-50 distributor tester
    - (1) Dynavision DS-3 ignition simulator
    - (1) AC PCV tester
    - (2) Sun 228 cylinder leakage testers
    - (1) Allen 29-05 automatic transmission tester
    - (2) Snap-on compression gauge tester
    - (1) Sun RDT-10 rectifier/diode tester
    - (3) Sun volt/amp testers (#40 and 28)
    - (1) Schildmeier 67hd wheel balancer
    - (1) MT 120 ignition tester (with spark generator)
    - (3) Fox Valley 121 GM connector adapters
    - (6) Stant cooling system testers
    - (1) Halogen leak tester
    - (1) Propane leak tester
    - (1) OTC 3200 Ultrasonic leak detector.

The Auto Club also maintains assorted jack stands, dial indicators, vacuum pumps, micrometers, brake measurement tools, impact wrenches, a thermometer, a battery charger, a volt/ohm meter, an air conditioner gauge set, a choke checker, a belt tension tool, a brake pedal load gauge, an oxyacetylene welder, a floor jack, tool boxes and hand tools.

11. Plans for Replacement: The St. Louis clinic is planning to buy a Hamilton Test Systems CEA emissions analyzer. No other equipment purchases are scheduled.

12. Technical Library: Contains OEM workshop service manuals, OEM technical service bulletins, and a MVMA technical specifications booklet. The facility is equipped with an on-going literature acquisition/filinq/updating system. Several technical libraries are located in the bays, the counseling area, the manager's office and the lanes, to provide easy access for all staff members.

13. Mobile Equipment: None is currently used.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: Equipment is maintained bi-monthly. The technical staff performs repairs unless there is an extreme problem. A good supply of spare parts is kept on hand. Minimal equipment downtime is experienced.

2. Frequency of Gas Calibration for Emissions Analyzers: The emissions analyzers are gas calibrated bi-monthly.

VII. FACILITY STAFFING

1. Program Director: Francis Oldham, Director of Technical Services.

2. Station Manager: Wayne Young.

3. Assistant Manager: (1) Shop Foreman.

4. Master Mechanics: (4) Lead Technicians.

5. Junior Mechanics: (5) Junior Technicians.

6. Diagnosticians: (1) Counselor.

7. Aides: (2) Receptionist/Cashiers.

8. Clerical: 1 typist.*

9. Other: 1 Appraiser (for AAA insurance service and damage inspection).

In the main lane, the lead technician, junior technician and lane technician helper shift positions to reduce boredom. Four employees work three lifts and deliver the cars to two employees working the lanes. They in turn hand the forms to the counselor.

VIII. TRAINING

1. Inspector Experience Requirements: The Auto Club of St. Louis generally hires technicians into entry-level positions. The requirements for a junior technician are:

- At least one year of automotive technical training. A number of the applicants have obtained a two-year Associate Degree in automotive mechanics.
- At least one year of hands-on mechanic's experience.
- A passing grade on the state inspector examination.
- A passing grade in one or more NIASE examinations, typically brakes, front-end, engine tune-up or electrical systems.

To progress from the junior technician to the technician level, the technician must demonstrate the following:

- Familiarity with the use of an engine analyzer for diagnosing engine malfunctions (including scope patterns).
- Increased familiarity with automotive powertrains, including the transmission and differential.
- Familiarity with the use of a dynamometer and a brake analyzer.

As the technician moves up from the junior to senior positions, further NIASE certification is encouraged but not required.

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* Repair recommendations are typed by either the typist or the receptionists.

2. Employee Training Provisions: The Auto Club will pay for the cost of NIASE tests, equipment manufacturer's courses and vehicle manufacturer's update clinics. The Club encourages the staff members to attend the local courses. On-the-job training is also provided. The Auto Club is planning a new position for a full-time trainer to handle both the St. Louis and Kansas City Clubs.

3. Technical Update Meetings: Informal staff meetings are held periodically. Every effort is made to educate the members on test methods employed at the center and on the latest advances in automotive technology.

IX. QUALITY CONTROL

1. Supervision for Inspectors: Constant supervision is provided by the station supervisors. The Auto Club also has a contract with a firm, Washington University Technical Associates, for quality control checks on the inspection process. An unidentified car is completely inspected by the Washington University Technical Associates staff and the Auto Club station manager. Then, the same car is run through the clinic and diagnosed by the inspectors. The two diagnostic reports are compared and discussed with the clinic inspectors. Then the inspectors are given an opportunity to do the inspection over again. This quality control check is performed four times per year.

2. Surveys of Customer Satisfaction: No surveys of customer satisfaction have been performed.

3. Criteria for Failure: The Auto Club has prepared a detailed summary of the inspection procedures and criteria in use at the clinics. This reference is available to all of the inspectors. Examples of the criteria follow:

[redacted]

- If any tire is undersize by one size or more, when compared to the published (OEM) specification for the model year, make and model, the condition should be rated "critical." The inspector first checks the wheel size with reference charts on the wall and then compares the tire with other tires on the car. If an undersize tire is suspected, the inspector checks the vehicle specifications.
- If the drum or disc braking surface is scored at one or more places to a depth not exceeding approximately 1/64 inch or 4/10 millimeter, the condition should be rated "borderline."
- If a u-joint has perceptible and/or sideways play between its cross and rollers, the condition should be rated "critical."
- If the thinnest point of a bonded lining or disc pad is 1/32 of an inch or less, the condition should be rated "critical."

The three ratings are:

- Okay, satisfactory.
- Borderline, will require attention in the future.
- Critical, should have immediate attention.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Repairs will be checked by the diagnostic clinic for $1.00 if the vehicle is brought back within 30 days. Both members and non-members can obtain reinspections.

If the vehicle is brought in for a recheck without receipts and between 30 and 60 days following the repair, the charge is $6.50 for both members and non-members. Rechecks for State Inspection defects after repairs are free. A copy of the recheck inspection form is shown in Figure 14.

XI. CUSTOMER INTERFACE

1. Counseling: The counselor provides each customer with a typed list of recommended repair actions (Figure 12) that may be handed directly to the repair facility. The customer also receives a copy of the completed inspection checklist (Figure 13). Counseling and explanation of the inspection items are provided in a separate counseling area.

2. Additional Customer Services: Literature is available in the customer waiting area such as Missouri brochure, "Money-Saving Tips for Missouri Motorists." There is also a slide presentation with synchronized 8-track tape that explains the entire inspection procedure.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: The complete inspection requires one hour, plus 1/4 to 1/2 hour for dictating and typing the report.

2. Time at Each Station in the Lane: The vehicle is in the bay between 30-40 minutes. The lane process is 2-3 minutes on the front wheel alignment tester, 15-20 minutes on the dynamometer. The actual main lane inspection takes about an hour. Dictating the report takes 10-15 minutes. The total inspection requires 1.5 hours per vehicle.

3. Theoretical Maximum Lane Throughput: If two to three mechanics could be added to the staff, the manager believes the clinic could process 50-55 cars in the main lane, which is 15-17 more than the present rate.

4. Average Lane Throughput: In an eight-hour day, the average lane throughput is 35-38 vehicles for main lane inspection; 10-12 vehicles for functional tests; 15-20 for Missouri state inspection; and 5-6 rechecks. The clinic is handling 50-60 cars a day with its present staff for the combination of services now performed.

5. Appointments Used: Yes.

6. Busiest Time of Year: May, August (vacation).

7. Maximum Number of Vehicles Processed per Hour for the Entire Facility: 4.75 vehicles per hour, 38 per day for main lane inspections. The limit is determined by the completeness and extent of the inspection, the efficiency of the work procedure and the availability of the appropriate personnel.

XIII. CONSUMER AND COMMUNITY RELATIONS

The St. Louis clinic has had some problems with local juveniles breaking windows. The Club is planning to replace existing glass windows with Lexan plastic to reduce this problem. Efforts are made to explain the services of the diagnostic facility to the repair industry.

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment: Information not available.

2. Current Average Hourly Labor Rate: The current union contract for technicians calls for a pay rate of from $6.27 to $8.13 per hour. A new contract is expected to be negotiated by Autumn, 1980.

3. Building and Land Costs:

   - $5,000 for building amortization
   - $3,500 for building maintenance
   - $20,000 for depreciation.

4. Utilities: $12,000 per year.

5. Labor Costs:

   - $110,000 for non-union salaries and fringe
   - $138,000 for testing labor
   - $18,000 for pension and welfare payments.

6. Total Budget for 1980:

Depreciation	$ 20,000
Non-union salary/fringe	110,000
Test labor	138,000
Welfare/pensions	18,000
Uniforms	4,500
Equipment maintenance	9,000
Advertising	3,000
Janitorial	12,000
Insurance	11,000
Utilities	12,000
Telephone/telegraph	8,000
Office supplies	2,500
Building maintenance	3,500

• Building amortization	$ 5,000
• Miscellaneous	26,500
Total expenditures	$383,000.
Budget Loss:	$383,000
	- 335,000*
	$ 48,000

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* Auto Club receipts for vehicle services.

[redacted]

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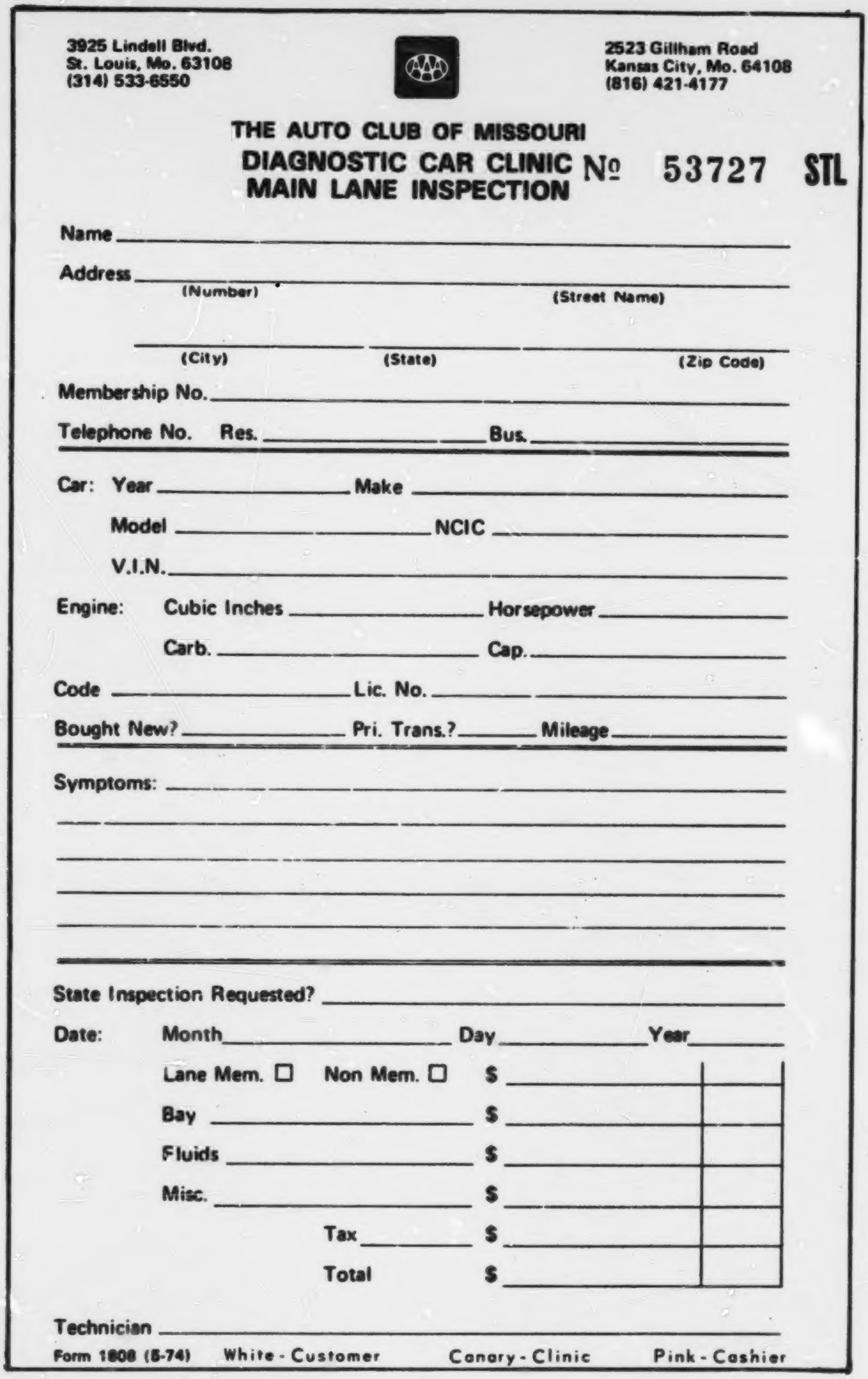


3925 Lindell Blvd.
St. Louis, Mo. 63108
(314) 533-6550

2523 Gillham Road
Kansas City, Mo. 64108
(816) 421-4177

THE AUTO CLUB OF MISSOURI
DIAGNOSTIC CAR CLINIC
MAIN LANE INSPECTION

№ 53727 STL

Name

Address (Number) (Street Name)

(City) (State) (Zip Code)

Membership No.

Telephone No. Res. Bus.

Car: Year Make

Model NCIC

V.I.N.

Engine: Cubic Inches Horsepower

Carb. Cap.

Code Lic. No.

Bought New? Pri. Trans.? Mileage

Symptoms:

State Inspection Requested?

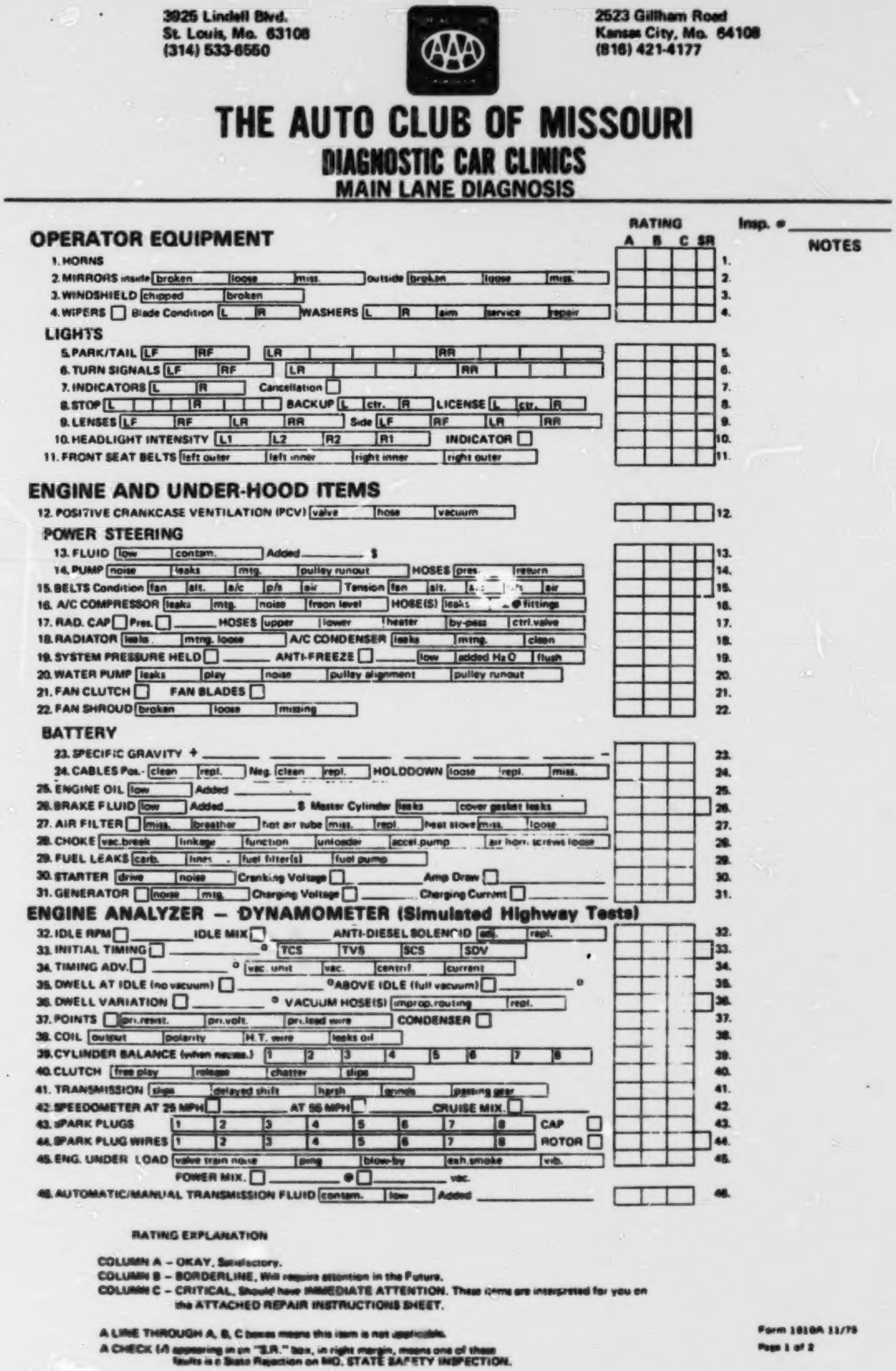
Date: Month Day Year

Lane Mem. ☐ Non Mem. ☐	$	
Bay	$	
Fluids	$	
Misc.	$	
Tax	$	
Total	$	

Technician

Form 1808 (5-74) White - Customer Canary - Clinic Pink - Cashier

FIGURE 3. MAIN LANE INSPECTION FORM SHOWING CUSTOMER AND VEHICLE INFORMATION



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THE AUTO CLUB OF MISSOURI
DIAGNOSTIC CAR CLINICS
MAIN LANE DIAGNOSIS

RATING A B C SR

Insp. # ____________

NOTES

OPERATOR EQUIPMENT

1. HORNS
2. MIRRORS inside broken loose miss. outside broken loose miss.
3. WINDSHIELD chipped broken
4. WIPERS ☐ Blade Condition L R WASHERS L R aim service repair

LIGHTS

5. PARK/TAIL LF RF LR RR
6. TURN SIGNALS LF RF LR RR
7. INDICATORS L R Cancellation ☐
8. STOP L R BACKUP L ctr. R LICENSE L ctr. R
9. LENSES LF RF LR RR Side LF RF LR RR
10. HEADLIGHT INTENSITY L1 L2 R2 R1 INDICATOR ☐
11. FRONT SEAT BELTS left outer left inner right inner right outer

ENGINE AND UNDER-HOOD ITEMS

12. POSITIVE CRANKCASE VENTILATION (PCV) valve hose vacuum

POWER STEERING

13. FLUID low contam. Added ________ $
14. PUMP noise leaks mtg. pulley runout HOSES pres. return
15. BELTS Condition fan alt. a/c p/s air Tension fan alt. a/c p/s air
16. A/C COMPRESSOR leaks mtg. noise freon level HOSE(S) leaks @ fittings
17. RAD. CAP ☐ Pres. ☐ ______ HOSES upper lower heater by-pass ctrl.valve
18. RADIATOR leaks mtng. loose A/C CONDENSER leaks mtng. clean
19. SYSTEM PRESSURE HELD ☐ ______ ANTI-FREEZE ☐ ______ low added H_2O flush
20. WATER PUMP leaks play noise pulley alignment pulley runout
21. FAN CLUTCH ☐ FAN BLADES ☐
22. FAN SHROUD broken loose missing

BATTERY

23. SPECIFIC GRAVITY + ______ ______ ______ ______ ______ ______ −
24. CABLES Pos. - clean repl. Neg. clean repl. HOLDDOWN loose repl. miss.
25. ENGINE OIL low Added ________
26. BRAKE FLUID low Added ________ $ Master Cylinder leaks cover gasket leaks
27. AIR FILTER ☐ miss. breather hot air tube miss. repl. heat stove miss. loose
28. CHOKE vac.break linkage function unloader accel.pump air horn screws loose
29. FUEL LEAKS carb. lines fuel filter(s) fuel pump
30. STARTER drive noise Cranking Voltage ☐ ________ Amp Draw ☐ ________
31. GENERATOR ☐ noise mtg. Charging Voltage ☐ ________ Charging Current ☐ ________

ENGINE ANALYZER — DYNAMOMETER (Simulated Highway Tests)

32. IDLE RPM ☐ ________ IDLE MIX ☐ ________ ANTI-DIESEL SOLENOID adj. repl.
33. INITIAL TIMING ☐ ________ ° TCS TVS SCS SDV
34. TIMING ADV. ☐ ________ ° vac. unit vac. centrif. current
35. DWELL AT IDLE (no vacuum) ☐ ________ ° ABOVE IDLE (full vacuum) ☐ ________ °
36. DWELL VARIATION ☐ ________ ° VACUUM HOSE(S) improp.routing repl.
37. POINTS ☐ pri.resist. pri.volt. pri.lead wire CONDENSER ☐
38. COIL output polarity H.T. wire leaks oil
39. CYLINDER BALANCE (when necess.) 1 2 3 4 5 6 7 8
40. CLUTCH free play release chatter slips
41. TRANSMISSION slips delayed shift harsh grinds passing gear
42. SPEEDOMETER AT 25 MPH ☐ ________ AT 55 MPH ☐ ________ CRUISE MIX. ☐ ________
43. SPARK PLUGS 1 2 3 4 5 6 7 8 CAP ☐
44. SPARK PLUG WIRES 1 2 3 4 5 6 7 8 ROTOR ☐
45. ENG. UNDER LOAD valve train noise ping blow-by exh.smoke vib.
POWER MIX. ☐ ________ @ ☐ ________ vac.
46. AUTOMATIC/MANUAL TRANSMISSION FLUID contam. low Added ____________

RATING EXPLANATION

COLUMN A – OKAY, Satisfactory.
COLUMN B – BORDERLINE, Will require attention in the Future.
COLUMN C – CRITICAL, Should have IMMEDIATE ATTENTION. These items are interpreted for you on the ATTACHED REPAIR INSTRUCTIONS SHEET.

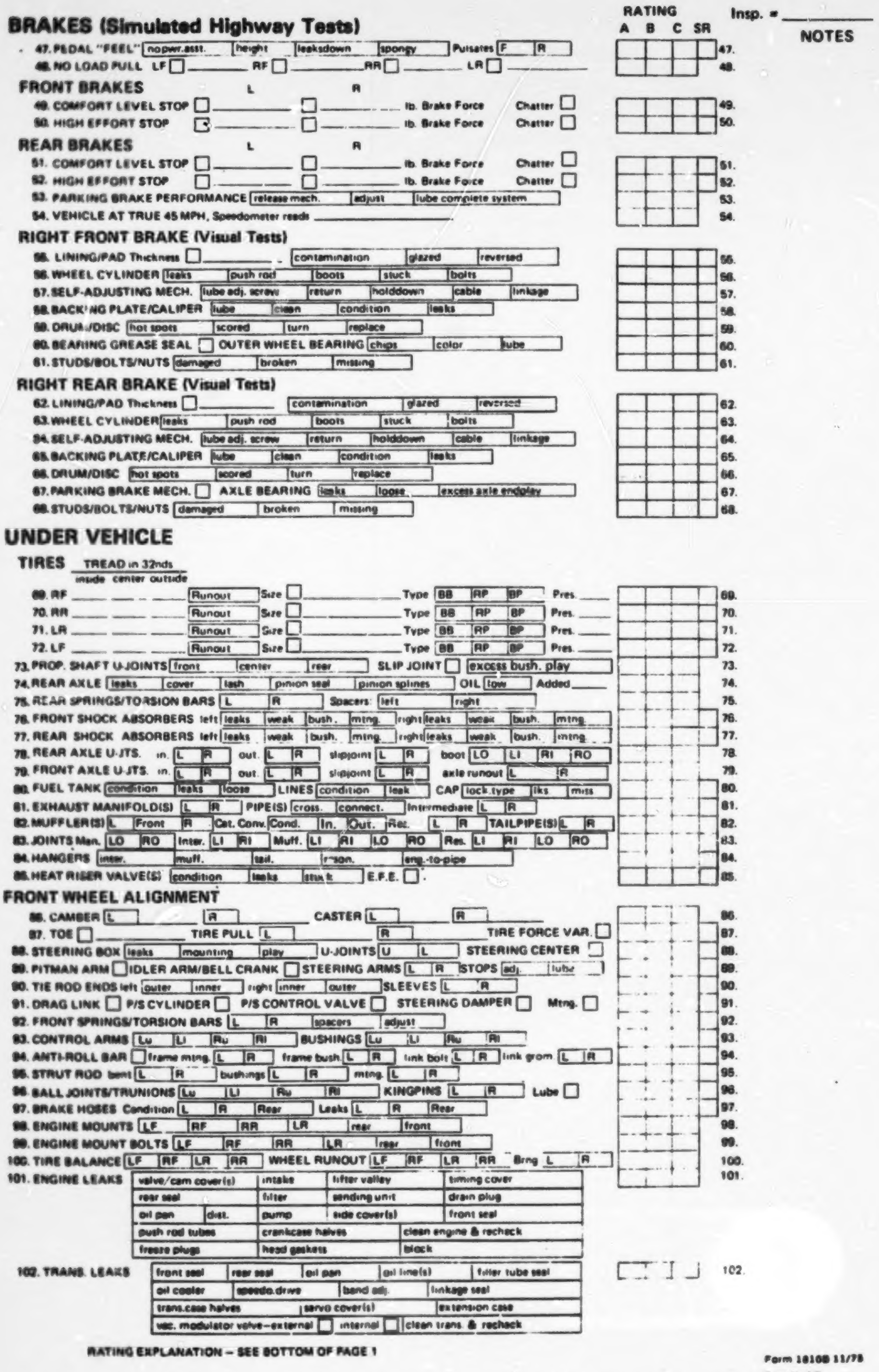
A LINE THROUGH A, B, C boxes means this item is not applicable.
A CHECK (✓) appearing in an "S.R." box, in right margin, means one of these faults is a State Rejection on MO. STATE SAFETY INSPECTION.

Form 1010A 11/75
Page 1 of 2

GURE 4. CHECKLIST OF INSPECTION ITEMS

BEST DOCUMENT AVAILABLE

[redacted]



RATING
A B C SR
Insp. # ____________
NOTES

BRAKES (Simulated Highway Tests)

47. PEDAL "FEEL" nopwr.asst. | height | leaksdown | spongy | Pulsates F | R
48. NO LOAD PULL LF ☐ ________ RF ☐ __________ RR ☐ ________ LR ☐ ____________

FRONT BRAKES L R

49. COMFORT LEVEL STOP ☐ ____________ ☐ ____________ lb. Brake Force Chatter ☐
50. HIGH EFFORT STOP ☐ ____________ ☐ ____________ lb. Brake Force Chatter ☐

REAR BRAKES L R

51. COMFORT LEVEL STOP ☐ ____________ ☐ ____________ lb. Brake Force Chatter ☐
52. HIGH EFFORT STOP ☐ ____________ ☐ ____________ lb. Brake Force Chatter ☐
53. PARKING BRAKE PERFORMANCE release mech. | adjust | lube complete system
54. VEHICLE AT TRUE 45 MPH, Speedometer reads ____________________

RIGHT FRONT BRAKE (Visual Tests)

55. LINING/PAD Thickness ☐ ____________ contamination | glazed | reversed
56. WHEEL CYLINDER leaks | push rod | boots | stuck | bolts
57. SELF-ADJUSTING MECH. lube adj. screw | return | holddown | cable | linkage
58. BACKING PLATE/CALIPER lube | clean | condition | leaks
59. DRUM/DISC hot spots | scored | turn | replace
60. BEARING GREASE SEAL ☐ OUTER WHEEL BEARING chips | color | lube
61. STUDS/BOLTS/NUTS damaged | broken | missing

RIGHT REAR BRAKE (Visual Tests)

62. LINING/PAD Thickness ☐ ____________ contamination | glazed | reversed
63. WHEEL CYLINDER leaks | push rod | boots | stuck | bolts
64. SELF-ADJUSTING MECH. lube adj. screw | return | holddown | cable | linkage
65. BACKING PLATE/CALIPER lube | clean | condition | leaks
66. DRUM/DISC hot spots | scored | turn | replace
67. PARKING BRAKE MECH. ☐ AXLE BEARING leaks | loose | excess axle endplay
68. STUDS/BOLTS/NUTS damaged | broken | missing

UNDER VEHICLE

TIRES TREAD in 32nds
inside center outside

69. RF ____ ____ ____ Runout Size ☐ ____________ Type BB | RP | BP Pres. ____
70. RR ____ ____ ____ Runout Size ☐ ____________ Type BB | RP | BP Pres. ____
71. LR ____ ____ ____ Runout Size ☐ ____________ Type BB | RP | BP Pres. ____
72. LF ____ ____ ____ Runout Size ☐ ____________ Type BB | RP | BP Pres. ____
73. PROP. SHAFT U-JOINTS front | center | rear SLIP JOINT ☐ excess bush. play
74. REAR AXLE leaks | cover | lash | pinion seal | pinion splines OIL low Added ____
75. REAR SPRINGS/TORSION BARS L | R Spacers: left | right
76. FRONT SHOCK ABSORBERS left leaks | weak | bush. | mtng. right leaks | weak | bush. | mtng.
77. REAR SHOCK ABSORBERS left leaks | weak | bush. | mtng. right leaks | weak | bush. | mtng.
78. REAR AXLE U-JTS. in. L | R out. L | R slipjoint L | R boot LO | LI | RI | RO
79. FRONT AXLE U-JTS. in. L | R out. L | R slipjoint L | R axle runout L | R
80. FUEL TANK condition | leaks | loose LINES condition | leak CAP lock type | lks | miss
81. EXHAUST MANIFOLD(S) L | R PIPE(S) cross. | connect. Intermediate L | R
82. MUFFLER(S) L | Front | R Cat. Conv. Cond. | In. | Out. Res. L | R TAILPIPE(S) L | R
83. JOINTS Man. LO | RO Inter. LI | RI Muff. LI | RI | LO | RO Res. LI | RI | LO | RO
84. HANGERS inter. | muff. | tail. | reson. | eng.-to-pipe
85. HEAT RISER VALVE(S) condition | leaks | stuck E.F.E. ☐

FRONT WHEEL ALIGNMENT

86. CAMBER L ________ R ________ CASTER L ________ R ________
87. TOE ☐ ____________ TIRE PULL L ____________ R ____________ TIRE FORCE VAR. ☐
88. STEERING BOX leaks | mounting | play U-JOINTS U | L STEERING CENTER ☐
89. PITMAN ARM ☐ IDLER ARM/BELL CRANK ☐ STEERING ARMS L | R STOPS adj. | lube
90. TIE ROD ENDS left outer | inner right inner | outer SLEEVES L | R
91. DRAG LINK ☐ P/S CYLINDER ☐ P/S CONTROL VALVE ☐ STEERING DAMPER ☐ Mtng. ☐
92. FRONT SPRINGS/TORSION BARS L | R | spacers | adjust
93. CONTROL ARMS Lu | Ll | Ru | Rl BUSHINGS Lu | Ll | Ru | Rl
94. ANTI-ROLL BAR ☐ frame mtng. L | R frame bush. L | R link bolt L | R link grom. L | R
95. STRUT ROD bent L | R bushings L | R mtng. L | R
96. BALL JOINTS/TRUNIONS Lu | Ll | Ru | Rl KINGPINS L | R Lube ☐
97. BRAKE HOSES Condition L | R | Rear Leaks L | R | Rear
98. ENGINE MOUNTS LF | RF | RR | LR | rear | front
99. ENGINE MOUNT BOLTS LF | RF | RR | LR | rear | front
100. TIRE BALANCE LF | RF | LR | RR WHEEL RUNOUT LF | RF | LR | RR Brng L | R
101. ENGINE LEAKS
valve/cam cover(s) | intake | lifter valley | timing cover
rear seal | filter | sending unit | drain plug
oil pan | dist. | pump | side cover(s) | front seal
push rod tubes | crankcase halves | clean engine & recheck
freeze plugs | head gaskets | block
102. TRANS. LEAKS
front seal | rear seal | oil pan | oil line(s) | filler tube seal
oil cooler | speedo.drive | band adj. | linkage seal
trans.case halves | servo cover(s) | extension case
vac. modulator valve—external ☐ internal ☐ | clean trans. & recheck

RATING EXPLANATION – SEE BOTTOM OF PAGE 1

Form 1810B 11/75
Page 2 of 2

FIGURE 4. CHECKLIST OF INSPECTION ITEMS (CONTINUED)

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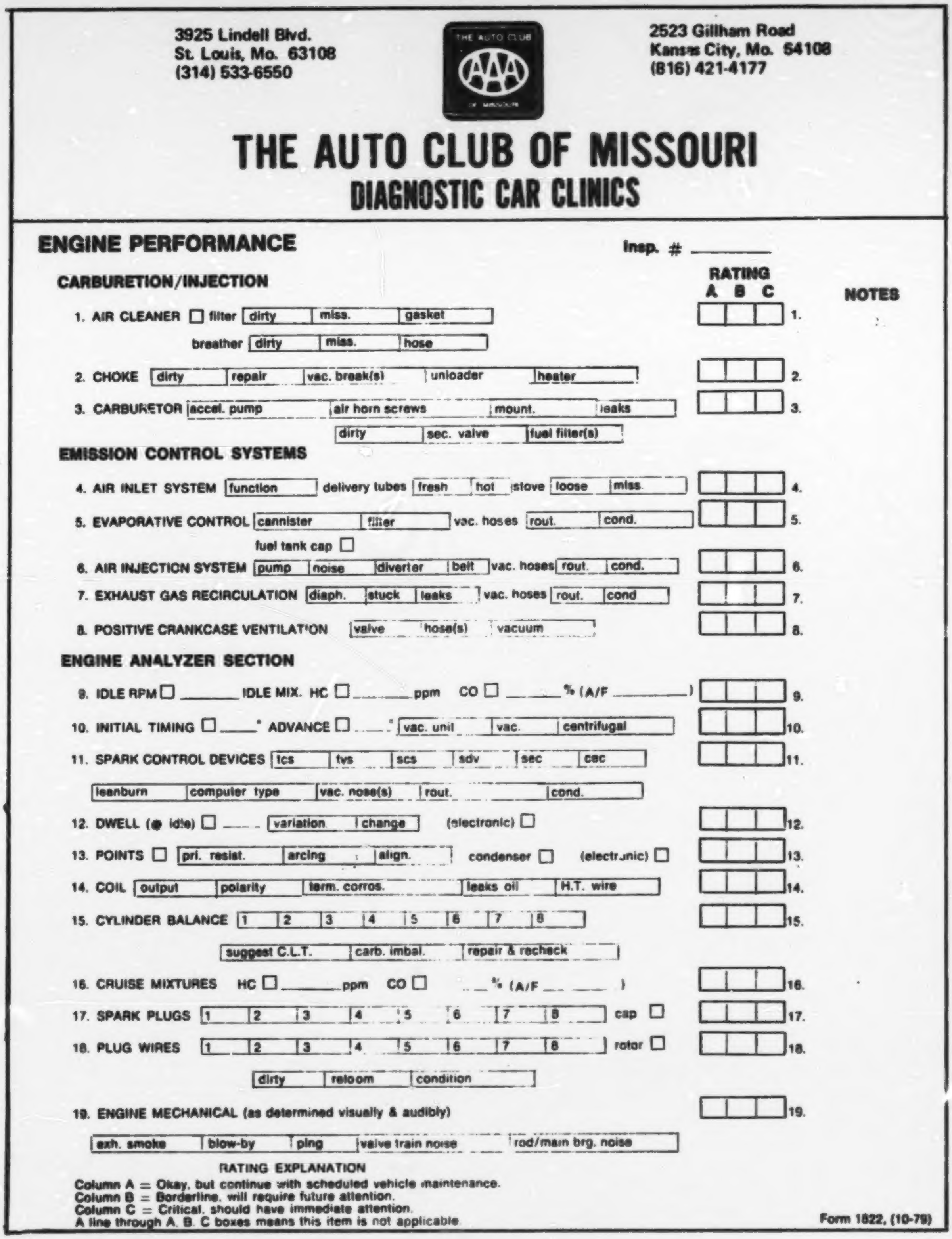

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THE AUTO CLUB OF MISSOURI
DIAGNOSTIC CAR CLINICS

ENGINE PERFORMANCE Insp. # ________

CARBURETION/INJECTION RATING A B C **NOTES**

1. AIR CLEANER ☐ filter | dirty | miss. | gasket | ☐☐☐ 1.
breather | dirty | miss. | hose |

2. CHOKE | dirty | repair | vac. break(s) | unloader | heater | ☐☐☐ 2.

3. CARBURETOR | accel. pump | air horn screws | mount. | leaks | ☐☐☐ 3.
| dirty | sec. valve | fuel filter(s) |

EMISSION CONTROL SYSTEMS

4. AIR INLET SYSTEM | function | delivery tubes | fresh | hot | stove | loose | miss. | ☐☐☐ 4.

5. EVAPORATIVE CONTROL | cannister | filter | vac. hoses | rout. | cond. | ☐☐☐ 5.
fuel tank cap ☐

6. AIR INJECTION SYSTEM | pump | noise | diverter | belt | vac. hoses | rout. | cond. | ☐☐☐ 6.

7. EXHAUST GAS RECIRCULATION | diaph. | stuck | leaks | vac. hoses | rout. | cond | ☐☐☐ 7.

8. POSITIVE CRANKCASE VENTILATION | valve | hose(s) | vacuum | ☐☐☐ 8.

ENGINE ANALYZER SECTION

9. IDLE RPM ☐ ______ IDLE MIX. HC ☐ ______ ppm CO ☐ ______ % (A/F ________) ☐☐☐ 9.

10. INITIAL TIMING ☐ ____° ADVANCE ☐ ____° | vac. unit | vac. | centrifugal | ☐☐☐ 10.

11. SPARK CONTROL DEVICES | tcs | tvs | scs | sdv | sec | cec | ☐☐☐ 11.
| leanburn | computer type | vac. hose(s) | rout. | cond. |

12. DWELL (@ idle) ☐ ____ | variation | change | (electronic) ☐ ☐☐☐ 12.

13. POINTS ☐ | pri. resist. | arcing | align. | condenser ☐ (electronic) ☐ ☐☐☐ 13.

14. COIL | output | polarity | term. corros. | leaks oil | H.T. wire | ☐☐☐ 14.

15. CYLINDER BALANCE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | ☐☐☐ 15.
| suggest C.L.T. | carb. imbal. | repair & recheck |

16. CRUISE MIXTURES HC ☐ ______ ppm CO ☐ ______ % (A/F ________) ☐☐☐ 16.

17. SPARK PLUGS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | cap ☐ ☐☐☐ 17.

18. PLUG WIRES | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | rotor ☐ ☐☐☐ 18.
| dirty | reloom | condition |

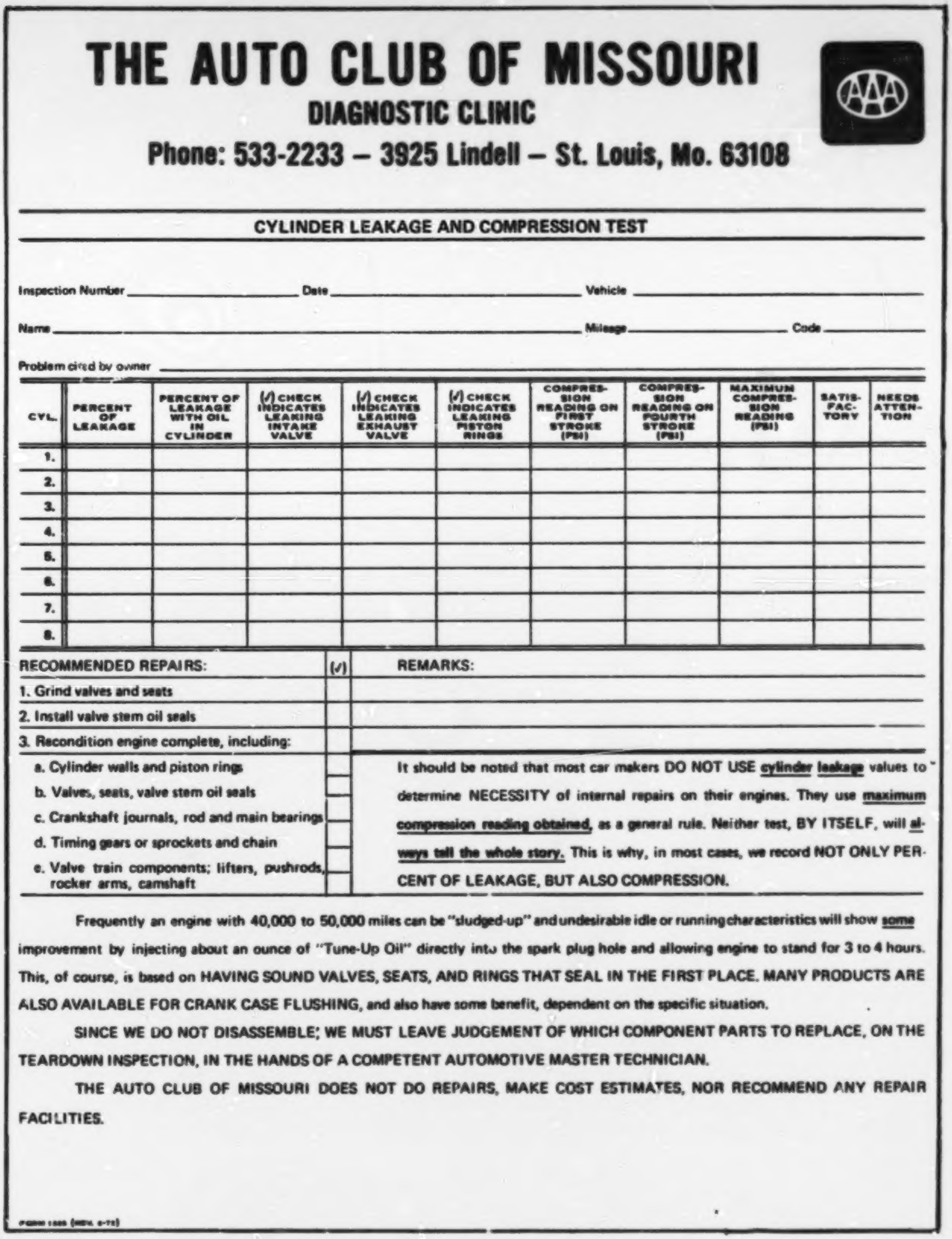
19. ENGINE MECHANICAL (as determined visually & audibly) ☐☐☐ 19.
| exh. smoke | blow-by | ping | valve train noise | rod/main brg. noise |

RATING EXPLANATION
Column A = Okay, but continue with scheduled vehicle maintenance.
Column B = Borderline, will require future attention.
Column C = Critical, should have immediate attention.
A line through A, B, C boxes means this item is not applicable.

Form 1822, (10-79)

FIGURE 5. ENGINE PERFORMANCE DIAGNOSTIC CHECKLIST

BEST DOCUMENT AVAILABLE



THE AUTO CLUB OF MISSOURI

DIAGNOSTIC CLINIC

Phone: 533-2233 – 3925 Lindell – St. Louis, Mo. 63108

CYLINDER LEAKAGE AND COMPRESSION TEST

Inspection Number ____________ Date ____________ Vehicle ____________

Name ____________ Mileage ____________ Code ____________

Problem cited by owner ____________

CYL.	PERCENT OF LEAKAGE	PERCENT OF LEAKAGE WITH OIL IN CYLINDER	(✓) CHECK INDICATES LEAKING INTAKE VALVE	(✓) CHECK INDICATES LEAKING EXHAUST VALVE	(✓) CHECK INDICATES LEAKING PISTON RINGS	COMPRESSION READING ON FIRST STROKE (PSI)	COMPRESSION READING ON FOURTH STROKE (PSI)	MAXIMUM COMPRESSION READING (PSI)	SATISFACTORY	NEEDS ATTENTION
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										

RECOMMENDED REPAIRS:	(✓)
1. Grind valves and seats	☐
2. Install valve stem oil seals	☐
3. Recondition engine complete, including:	☐
a. Cylinder walls and piston rings	☐
b. Valves, seats, valve stem oil seals	☐
c. Crankshaft journals, rod and main bearings	☐
d. Timing gears or sprockets and chain	☐
e. Valve train components; lifters, pushrods, rocker arms, camshaft	☐

REMARKS: ____________

It should be noted that most car makers DO NOT USE cylinder leakage values to determine NECESSITY of internal repairs on their engines. They use maximum compression reading obtained, as a general rule. Neither test, BY ITSELF, will always tell the whole story. This is why, in most cases, we record NOT ONLY PERCENT OF LEAKAGE, BUT ALSO COMPRESSION.

Frequently an engine with 40,000 to 50,000 miles can be "sludged-up" and undesirable idle or running characteristics will show some improvement by injecting about an ounce of "Tune-Up Oil" directly into the spark plug hole and allowing engine to stand for 3 to 4 hours. This, of course, is based on HAVING SOUND VALVES, SEATS, AND RINGS THAT SEAL IN THE FIRST PLACE. MANY PRODUCTS ARE ALSO AVAILABLE FOR CRANK CASE FLUSHING, and also have some benefit, dependent on the specific situation.

SINCE WE DO NOT DISASSEMBLE; WE MUST LEAVE JUDGEMENT OF WHICH COMPONENT PARTS TO REPLACE, ON THE TEARDOWN INSPECTION, IN THE HANDS OF A COMPETENT AUTOMOTIVE MASTER TECHNICIAN.

THE AUTO CLUB OF MISSOURI DOES NOT DO REPAIRS, MAKE COST ESTIMATES, NOR RECOMMEND ANY REPAIR FACILITIES.

[illegible]

FIGURE 6. CYLINDER LEAKAGE AND COMPRESSION TEST DIAGNOSTIC CHECKLIST

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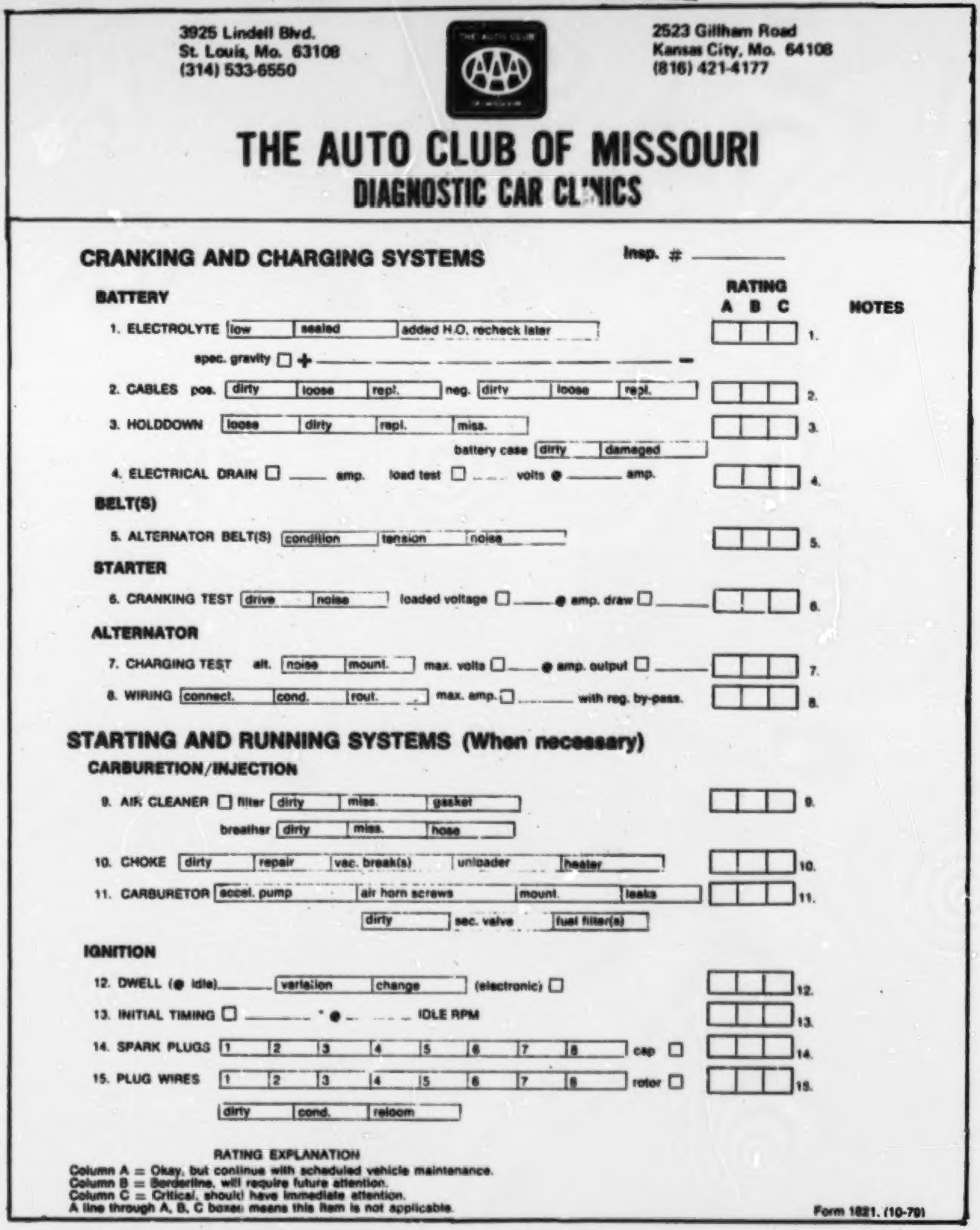

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THE AUTO CLUB OF MISSOURI
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CRANKING AND CHARGING SYSTEMS Insp. # ________

RATING A B C — NOTES

BATTERY

1. ELECTROLYTE [low | sealed | added H.O. recheck later] ☐☐☐ 1.

spec. gravity ☐ + ____ ____ ____ ____ ____ ____ –

2. CABLES pos. [dirty | loose | repl.] neg. [dirty | loose | repl.] ☐☐☐ 2.

3. HOLDDOWN [loose | dirty | repl. | miss.] ☐☐☐ 3.

battery case [dirty | damaged]

4. ELECTRICAL DRAIN ☐ ____ amp. load test ☐ ____ volts @ ____ amp. ☐☐☐ 4.

BELT(S)

5. ALTERNATOR BELT(S) [condition | tension | noise] ☐☐☐ 5.

STARTER

6. CRANKING TEST [drive | noise] loaded voltage ☐ ____ @ amp. draw ☐ ____ ☐☐☐ 6.

ALTERNATOR

7. CHARGING TEST alt. [noise | mount.] max. volts ☐ ____ @ amp. output ☐ ____ ☐☐☐ 7.

8. WIRING [connect. | cond. | rout.] max. amp. ☐ ____ with reg. by-pass. ☐☐☐ 8.

STARTING AND RUNNING SYSTEMS (When necessary)

CARBURETION/INJECTION

9. AIR CLEANER ☐ filter [dirty | miss. | gasket] ☐☐☐ 9.

breather [dirty | miss. | hose]

10. CHOKE [dirty | repair | vac. break(s) | unloader | heater] ☐☐☐ 10.

11. CARBURETOR [accel. pump | air horn screws | mount. | leaks] ☐☐☐ 11.

[dirty] sec. valve [fuel filter(s)]

IGNITION

12. DWELL (@ idle) ____ [variation | change] (electronic) ☐ ☐☐☐ 12.

13. INITIAL TIMING ☐ ____ ° @ ____ IDLE RPM ☐☐☐ 13.

14. SPARK PLUGS [1 | 2 | 3 | 4 | 5 | 6 | 7 | 8] cap ☐ ☐☐☐ 14.

15. PLUG WIRES [1 | 2 | 3 | 4 | 5 | 6 | 7 | 8] rotor ☐ ☐☐☐ 15.

[dirty | cond. | reloom]

RATING EXPLANATION
Column A = Okay, but continue with scheduled vehicle maintenance.
Column B = Borderline, will require future attention.
Column C = Critical, should have immediate attention.
A line through A, B, C boxes means this item is not applicable.

Form 1821. (10-79)

FIGURE 7. CRANKING AND CHARGING SYSTEMS DIAGNOSTIC CHECKLIST

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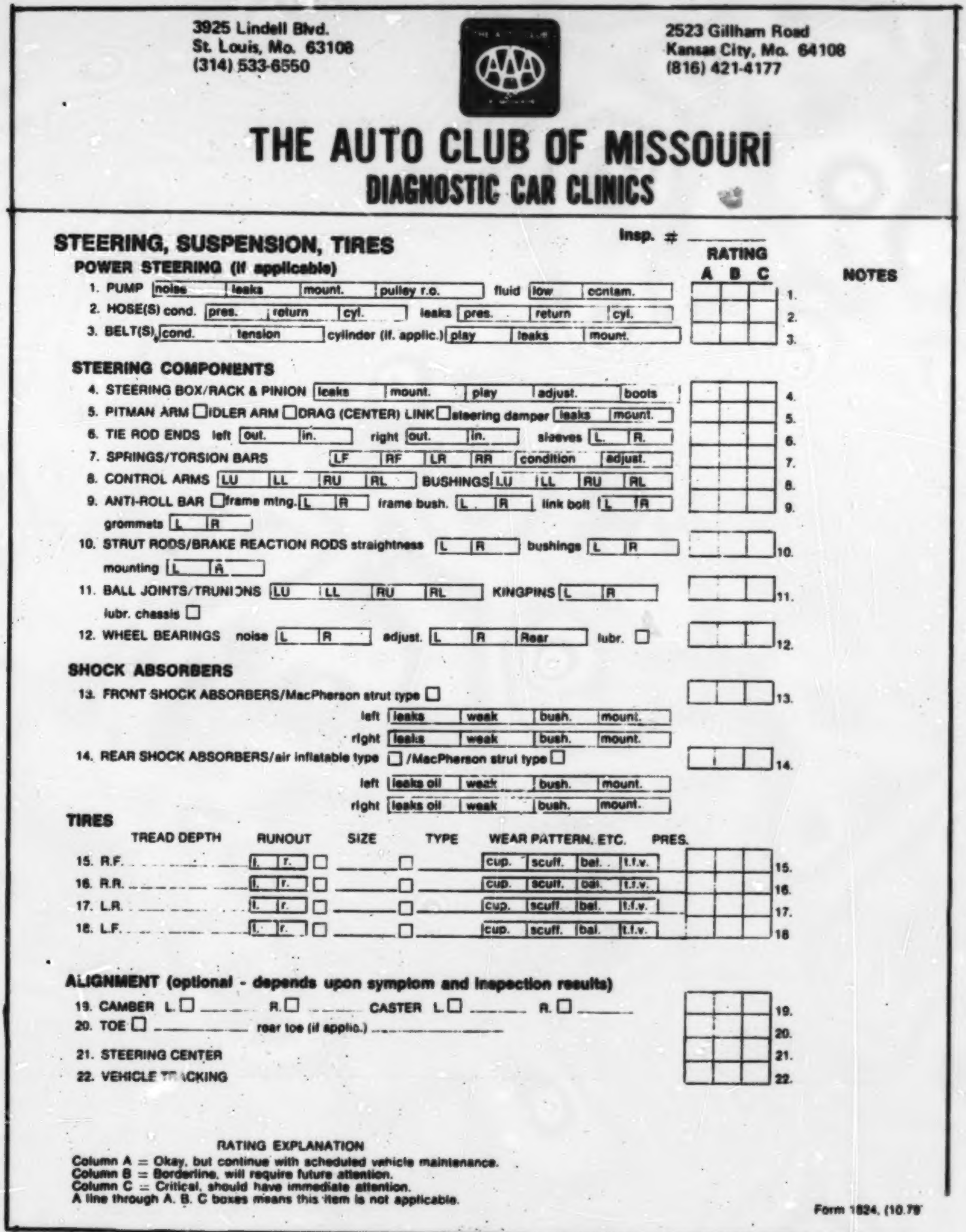

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THE AUTO CLUB OF MISSOURI
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STEERING, SUSPENSION, TIRES

Insp. # ________

RATING A B C — NOTES

POWER STEERING (if applicable)

1. PUMP noise | leaks | mount. | pulley r.o. — fluid low | contam.
2. HOSE(S) cond. pres. | return | cyl. — leaks pres. | return | cyl.
3. BELT(S) cond. | tension — cylinder (if. applic.) play | leaks | mount.

STEERING COMPONENTS

4. STEERING BOX/RACK & PINION leaks | mount. | play | adjust. | boots
5. PITMAN ARM ☐ IDLER ARM ☐ DRAG (CENTER) LINK ☐ steering damper leaks | mount.
6. TIE ROD ENDS left out. | in. — right out. | in. — sleeves L. | R.
7. SPRINGS/TORSION BARS LF | RF | LR | RR | condition | adjust.
8. CONTROL ARMS LU | LL | RU | RL — BUSHINGS LU | LL | RU | RL
9. ANTI-ROLL BAR ☐ frame mtng. L | R — frame bush. L | R — link bolt L | R — grommets L | R
10. STRUT RODS/BRAKE REACTION RODS straightness L | R — bushings L | R — mounting L | R
11. BALL JOINTS/TRUNIONS LU | LL | RU | RL — KINGPINS L | R — lubr. chassis ☐
12. WHEEL BEARINGS noise L | R — adjust. L | R | Rear — lubr. ☐

SHOCK ABSORBERS

13. FRONT SHOCK ABSORBERS/MacPherson strut type ☐
left leaks | weak | bush. | mount.
right leaks | weak | bush. | mount.
14. REAR SHOCK ABSORBERS/air inflatable type ☐ /MacPherson strut type ☐
left leaks oil | weak | bush. | mount.
right leaks oil | weak | bush. | mount.

TIRES

	TREAD DEPTH	RUNOUT	SIZE	TYPE	WEAR PATTERN, ETC.	PRES.
15. R.F.	________	l. r. ☐	________ ☐	________	cup. scuff. bal. t.f.v.	
16. R.R.	________	l. r. ☐	________ ☐	________	cup. scuff. bal. t.f.v.	
17. L.R.	________	l. r. ☐	________ ☐	________	cup. scuff. bal. t.f.v.	
18. L.F.	________	l. r. ☐	________ ☐	________	cup. scuff. bal. t.f.v.	

ALIGNMENT (optional - depends upon symptom and inspection results)

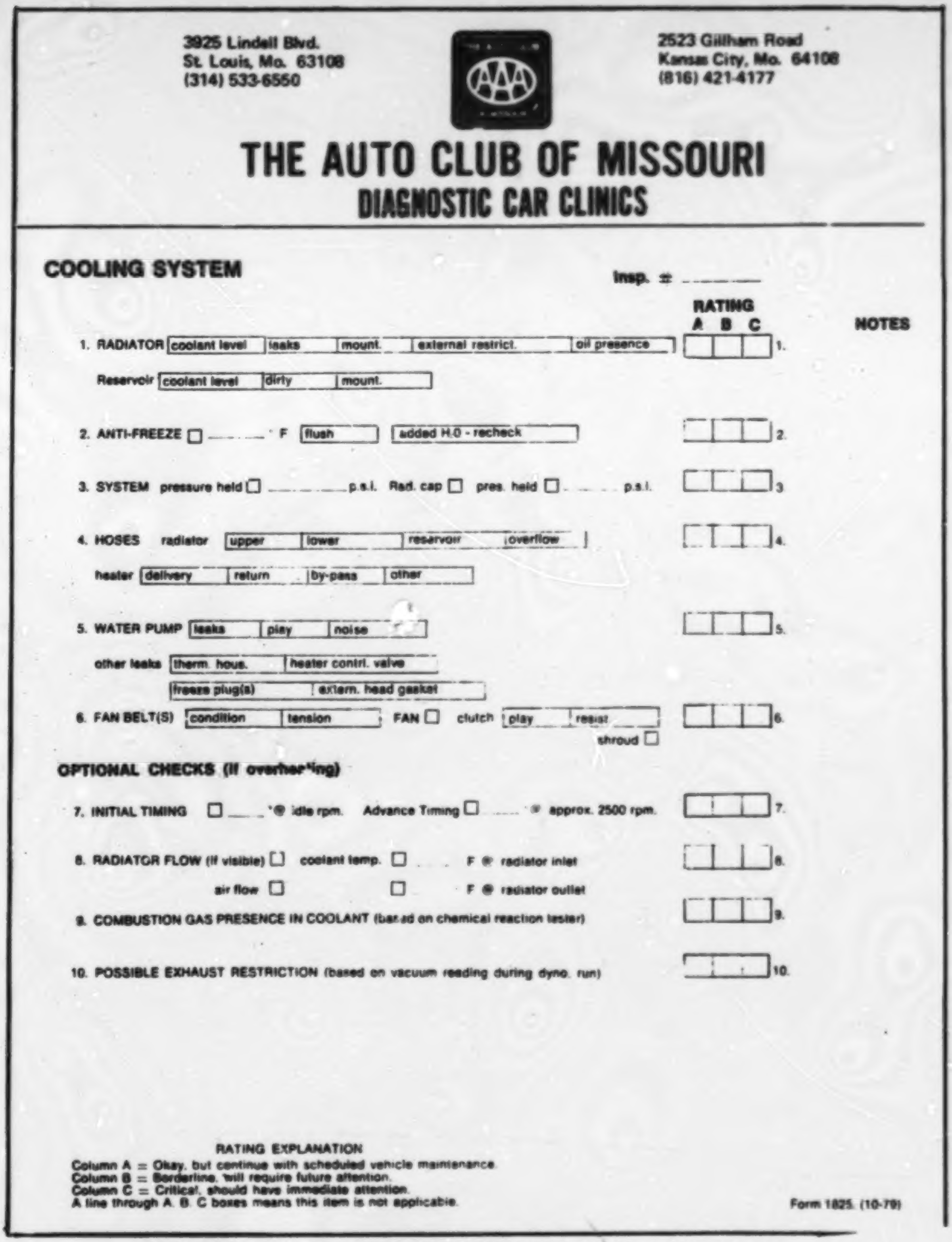
19. CAMBER L. ☐ ______ R. ☐ ______ CASTER L. ☐ ______ R. ☐ ______
20. TOE ☐ ____________ rear toe (if applic.) ____________
21. STEERING CENTER
22. VEHICLE TRACKING

RATING EXPLANATION

Column A = Okay, but continue with scheduled vehicle maintenance.
Column B = Borderline, will require future attention.
Column C = Critical, should have immediate attention.
A line through A. B. C boxes means this item is not applicable.

Form 1824. (10.79

FIGURE 8. STEERING, SUSPENSION, TIRES DIAGNOSTIC CHECKLIST



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COOLING SYSTEM Insp. # ______

RATING A B C — NOTES

1. RADIATOR coolant level | leaks | mount. | external restrict. | oil presence ☐☐☐ 1.
   Reservoir coolant level | dirty | mount.
2. ANTI-FREEZE ☐ ______ ° F flush | added H_2O - recheck ☐☐☐ 2.
3. SYSTEM pressure held ☐ ______ p.s.i. Rad. cap ☐ pres. held ☐ ______ p.s.i. ☐☐☐ 3
4. HOSES radiator upper | lower | reservoir | overflow ☐☐☐ 4.
   heater delivery | return | by-pass | other
5. WATER PUMP leaks | play | noise ☐☐☐ 5.
   other leaks therm. hous. | heater contrl. valve
   freeze plug(s) | extern. head gasket
6. FAN BELT(S) condition | tension FAN ☐ clutch play | resist ☐☐☐ 6.
   shroud ☐

OPTIONAL CHECKS (if overheating)

7. INITIAL TIMING ☐ ____ ° @ idle rpm. Advance Timing ☐ ____ ° @ approx. 2500 rpm. ☐☐☐ 7.
8. RADIATOR FLOW (if visible) ☐ coolant temp. ☐ ____ F @ radiator inlet ☐☐☐ 8.
   air flow ☐ ☐ ____ F @ radiator outlet
9. COMBUSTION GAS PRESENCE IN COOLANT (based on chemical reaction tester) ☐☐☐ 9.
10. POSSIBLE EXHAUST RESTRICTION (based on vacuum reading during dyno. run) ☐☐☐ 10.

RATING EXPLANATION
Column A = Okay, but continue with scheduled vehicle maintenance.
Column B = Borderline, will require future attention.
Column C = Critical, should have immediate attention.
A line through A, B, C boxes means this item is not applicable.

Form 1825 (10-79)

FIGURE 9. COOLING SYSTEM DIAGNOSTIC CHECKLIST

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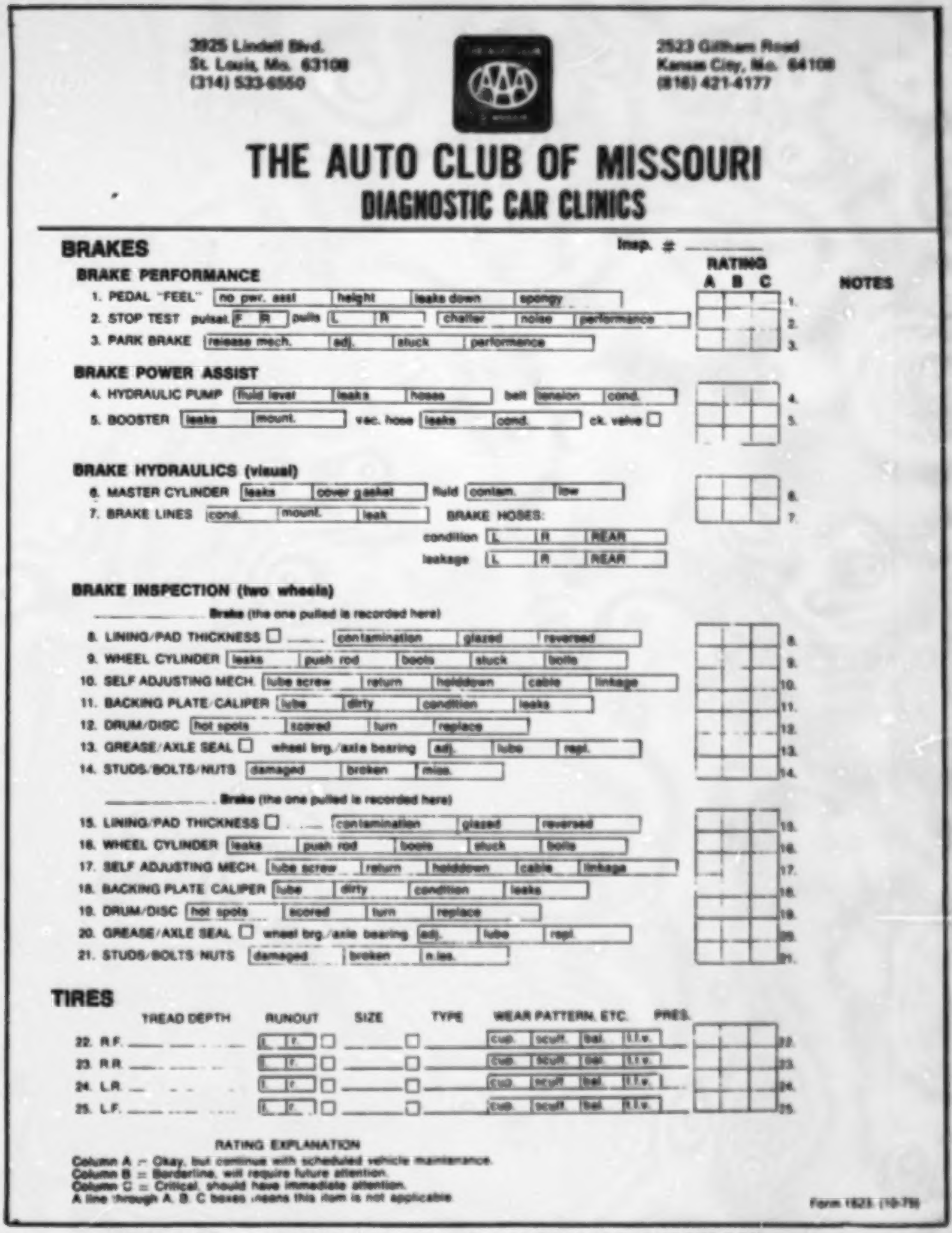

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BRAKES

Insp. # ________

RATING A B C — NOTES

BRAKE PERFORMANCE

1. PEDAL "FEEL" no pwr. asst | height | leaks down | spongy ☐☐☐ 1.
2. STOP TEST pulsat. F | R pulls L | R chatter | noise | performance ☐☐☐ 2.
3. PARK BRAKE release mech. | adj. | stuck | performance ☐☐☐ 3.

BRAKE POWER ASSIST

4. HYDRAULIC PUMP fluid level | leaks | hoses belt tension | cond. ☐☐☐ 4.
5. BOOSTER leaks | mount. vac. hose leaks | cond. ck. valve ☐ ☐☐☐ 5.

BRAKE HYDRAULICS (visual)

6. MASTER CYLINDER leaks | cover gasket fluid contam. | low ☐☐☐ 6.
7. BRAKE LINES cond. | mount. | leak BRAKE HOSES: ☐☐☐ 7.

condition L | R | REAR
leakage L | R | REAR

BRAKE INSPECTION (two wheels)

________ **Brake** (the one pulled is recorded here)

8. LINING/PAD THICKNESS ☐ ____ contamination | glazed | reversed ☐☐☐ 8.
9. WHEEL CYLINDER leaks | push rod | boots | stuck | bolts ☐☐☐ 9.
10. SELF ADJUSTING MECH. lube screw | return | holddown | cable | linkage ☐☐☐ 10.
11. BACKING PLATE/CALIPER lube | dirty | condition | leaks ☐☐☐ 11.
12. DRUM/DISC hot spots | scored | turn | replace ☐☐☐ 12.
13. GREASE/AXLE SEAL ☐ wheel brg./axle bearing adj. | lube | repl. ☐☐☐ 13.
14. STUDS/BOLTS/NUTS damaged | broken | miss. ☐☐☐ 14.

________ **Brake** (the one pulled is recorded here)

15. LINING/PAD THICKNESS ☐ ____ contamination | glazed | reversed ☐☐☐ 15.
16. WHEEL CYLINDER leaks | push rod | boots | stuck | bolts ☐☐☐ 16.
17. SELF ADJUSTING MECH. lube screw | return | holddown | cable | linkage ☐☐☐ 17.
18. BACKING PLATE CALIPER lube | dirty | condition | leaks ☐☐☐ 18.
19. DRUM/DISC hot spots | scored | turn | replace ☐☐☐ 19.
20. GREASE/AXLE SEAL ☐ wheel brg./axle bearing adj. | lube | repl. ☐☐☐ 20.
21. STUDS/BOLTS NUTS damaged | broken | n.iss. ☐☐☐ 21.

TIRES

	TREAD DEPTH	RUNOUT		SIZE		TYPE	WEAR PATTERN, ETC.	PRES.	A	B	C	
22. R.F.	____	l. | r.	☐	____	☐	____	cup. | scuff | bal. | t.t.v.	____	☐	☐	☐	22.
23. R.R.	____	l. | r.	☐	____	☐	____	cup. | scuff | bal. | t.t.v.	____	☐	☐	☐	23.
24. L.R.	____	l. | r.	☐	____	☐	____	cup. | scuff | bal. | t.t.v.	____	☐	☐	☐	24.
25. L.F.	____	l. | r.	☐	____	☐	____	cup. | scuff | bal. | t.t.v.	____	☐	☐	☐	25.

RATING EXPLANATION

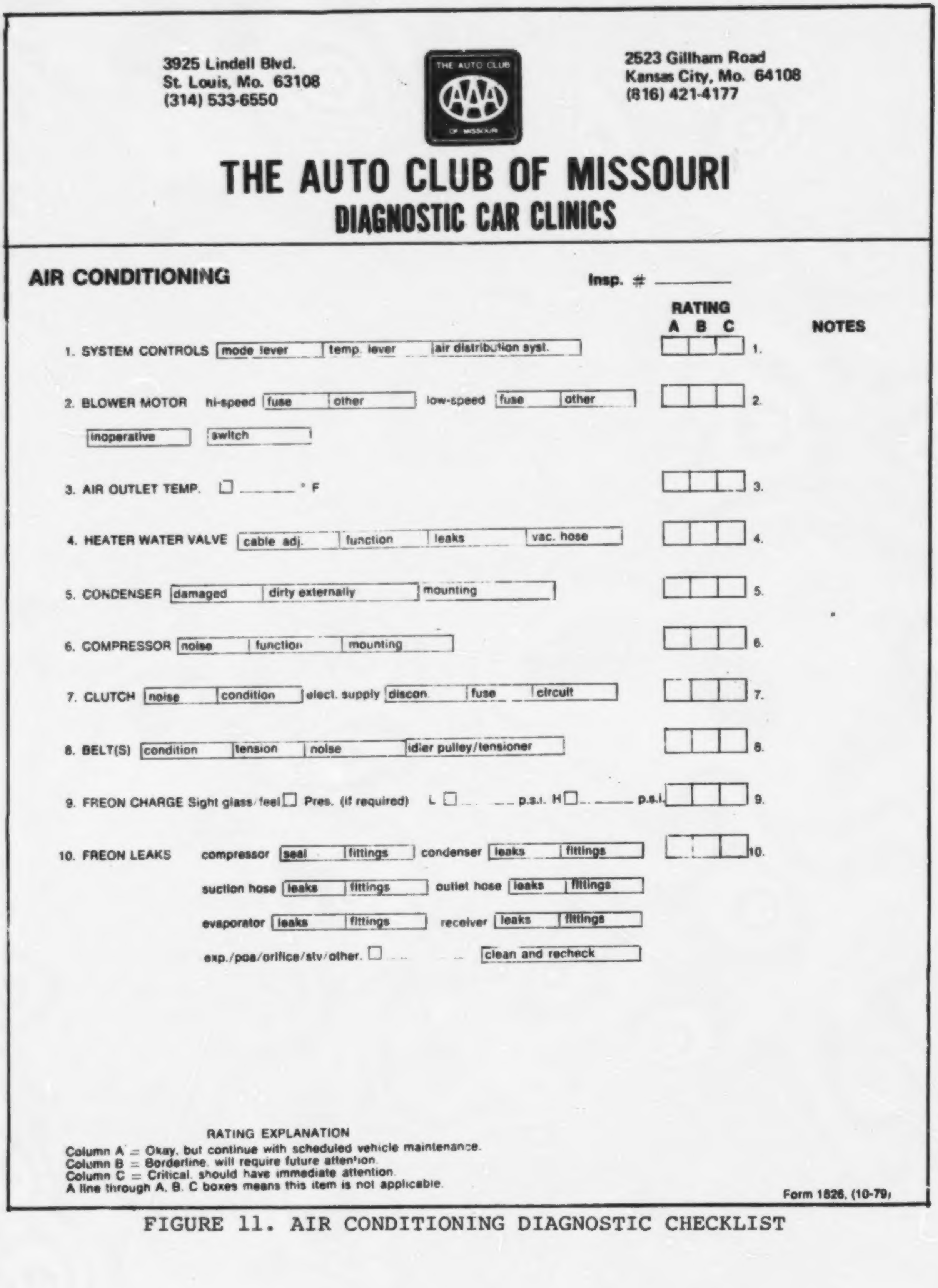
Column A — Okay, but continue with scheduled vehicle maintenance.
Column B = Borderline, will require future attention.
Column C = Critical, should have immediate attention.
A line through A, B, C boxes means this item is not applicable.

Form 1523 (10-75)

FIGURE 10. BRAKES AND TIRES DIAGNOSTIC CHECKLIST

BEST DOCUMENT AVAILABLE

[redacted]



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St. Louis, Mo. 63108
(314) 533-6550

2523 Gillham Road
Kansas City, Mo. 64108
(816) 421-4177

THE AUTO CLUB OF MISSOURI
DIAGNOSTIC CAR CLINICS

AIR CONDITIONING Insp. # ________

RATING A B C — NOTES

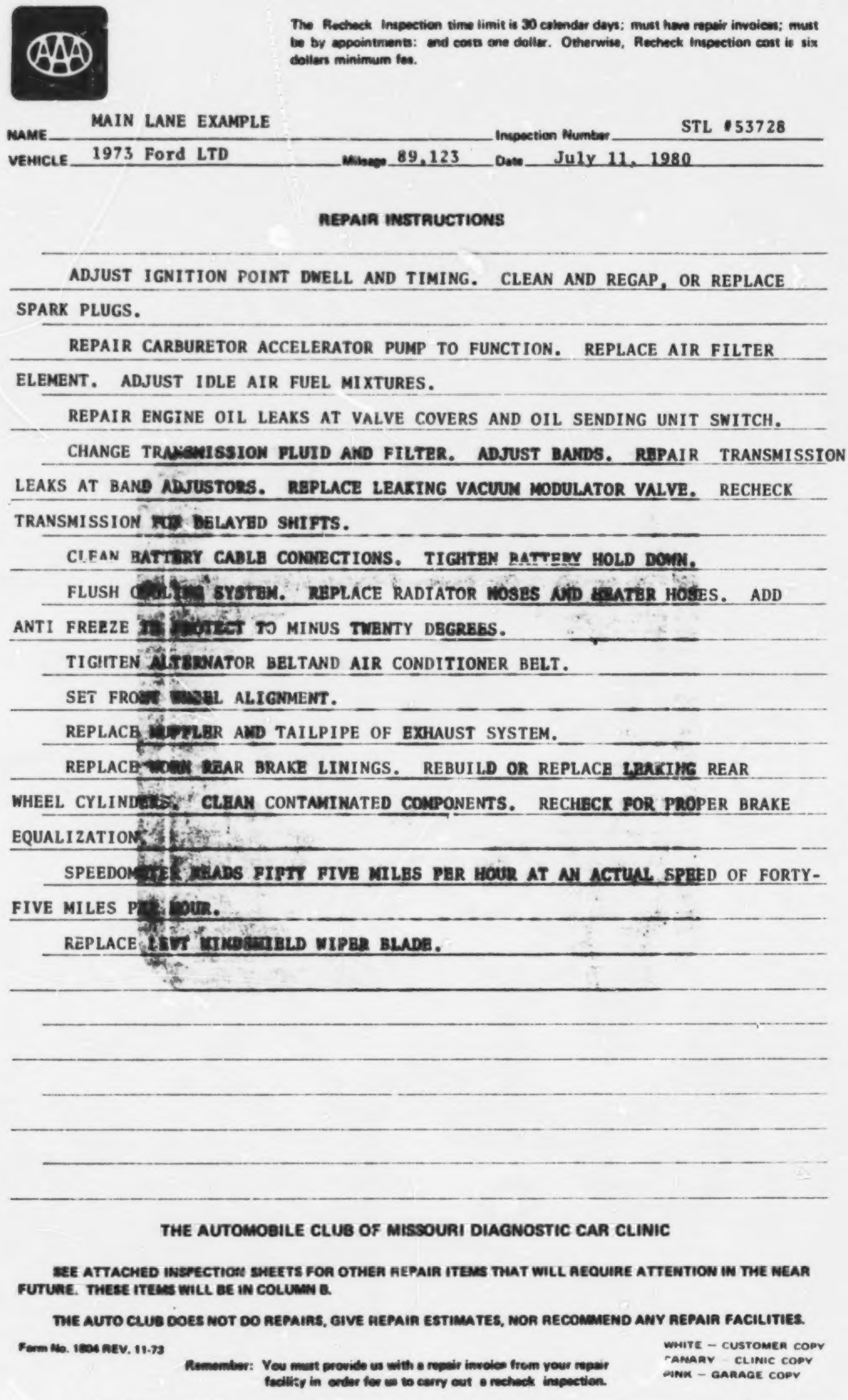
1. SYSTEM CONTROLS ☐ mode lever ☐ temp. lever ☐ air distribution syst. — ☐☐☐ 1.
2. BLOWER MOTOR hi-speed ☐ fuse ☐ other low-speed ☐ fuse ☐ other ☐ inoperative ☐ switch — ☐☐☐ 2.
3. AIR OUTLET TEMP. ☐ ______ ° F — ☐☐☐ 3.
4. HEATER WATER VALVE ☐ cable adj. ☐ function ☐ leaks ☐ vac. hose — ☐☐☐ 4.
5. CONDENSER ☐ damaged ☐ dirty externally ☐ mounting — ☐☐☐ 5.
6. COMPRESSOR ☐ noise ☐ function ☐ mounting — ☐☐☐ 6.
7. CLUTCH ☐ noise ☐ condition elect. supply ☐ discon. ☐ fuse ☐ circuit — ☐☐☐ 7.
8. BELT(S) ☐ condition ☐ tension ☐ noise ☐ idler pulley/tensioner — ☐☐☐ 8.
9. FREON CHARGE Sight glass/feel ☐ Pres. (if required) L ☐ ______ p.s.i. H ☐ ______ p.s.i. — ☐☐☐ 9.
10. FREON LEAKS compressor ☐ seal ☐ fittings condenser ☐ leaks ☐ fittings — ☐☐☐ 10.
    suction hose ☐ leaks ☐ fittings outlet hose ☐ leaks ☐ fittings
    evaporator ☐ leaks ☐ fittings receiver ☐ leaks ☐ fittings
    exp./poa/orifice/stv/other. ☐ ________ ☐ clean and recheck

RATING EXPLANATION
Column A = Okay, but continue with scheduled vehicle maintenance.
Column B = Borderline, will require future attention.
Column C = Critical, should have immediate attention.
A line through A, B, C boxes means this item is not applicable.

Form 1826, (10-79)

FIGURE 11. AIR CONDITIONING DIAGNOSTIC CHECKLIST

BEST DOCUMENT AVAILABLE



The Recheck Inspection time limit is 30 calendar days; must have repair invoices; must be by appointments: and costs one dollar. Otherwise, Recheck Inspection cost is six dollars minimum fee.

NAME MAIN LANE EXAMPLE
Inspection Number STL #53728
VEHICLE 1973 Ford LTD
Mileage 89,123
Date July 11, 1980

REPAIR INSTRUCTIONS

ADJUST IGNITION POINT DWELL AND TIMING. CLEAN AND REGAP, OR REPLACE SPARK PLUGS.

REPAIR CARBURETOR ACCELERATOR PUMP TO FUNCTION. REPLACE AIR FILTER ELEMENT. ADJUST IDLE AIR FUEL MIXTURES.

REPAIR ENGINE OIL LEAKS AT VALVE COVERS AND OIL SENDING UNIT SWITCH.

CHANGE TRANSMISSION FLUID AND FILTER. ADJUST BANDS. REPAIR TRANSMISSION LEAKS AT BAND ADJUSTORS. REPLACE LEAKING VACUUM MODULATOR VALVE. RECHECK TRANSMISSION FOR DELAYED SHIFTS.

CLEAN BATTERY CABLE CONNECTIONS. TIGHTEN BATTERY HOLD DOWN.

FLUSH COOLING SYSTEM. REPLACE RADIATOR HOSES AND HEATER HOSES. ADD ANTI FREEZE TO PROTECT TO MINUS TWENTY DEGREES.

TIGHTEN ALTERNATOR BELTAND AIR CONDITIONER BELT.

SET FRONT WHEEL ALIGNMENT.

REPLACE MUFFLER AND TAILPIPE OF EXHAUST SYSTEM.

REPLACE WORN REAR BRAKE LININGS. REBUILD OR REPLACE LEAKING REAR WHEEL CYLINDERS. CLEAN CONTAMINATED COMPONENTS. RECHECK FOR PROPER BRAKE EQUALIZATION.

SPEEDOMETER READS FIFTY FIVE MILES PER HOUR AT AN ACTUAL SPEED OF FORTY-FIVE MILES PER HOUR.

REPLACE LEFT WINDSHIELD WIPER BLADE.

THE AUTOMOBILE CLUB OF MISSOURI DIAGNOSTIC CAR CLINIC

SEE ATTACHED INSPECTION SHEETS FOR OTHER REPAIR ITEMS THAT WILL REQUIRE ATTENTION IN THE NEAR FUTURE. THESE ITEMS WILL BE IN COLUMN B.

THE AUTO CLUB DOES NOT DO REPAIRS, GIVE REPAIR ESTIMATES, NOR RECOMMEND ANY REPAIR FACILITIES.

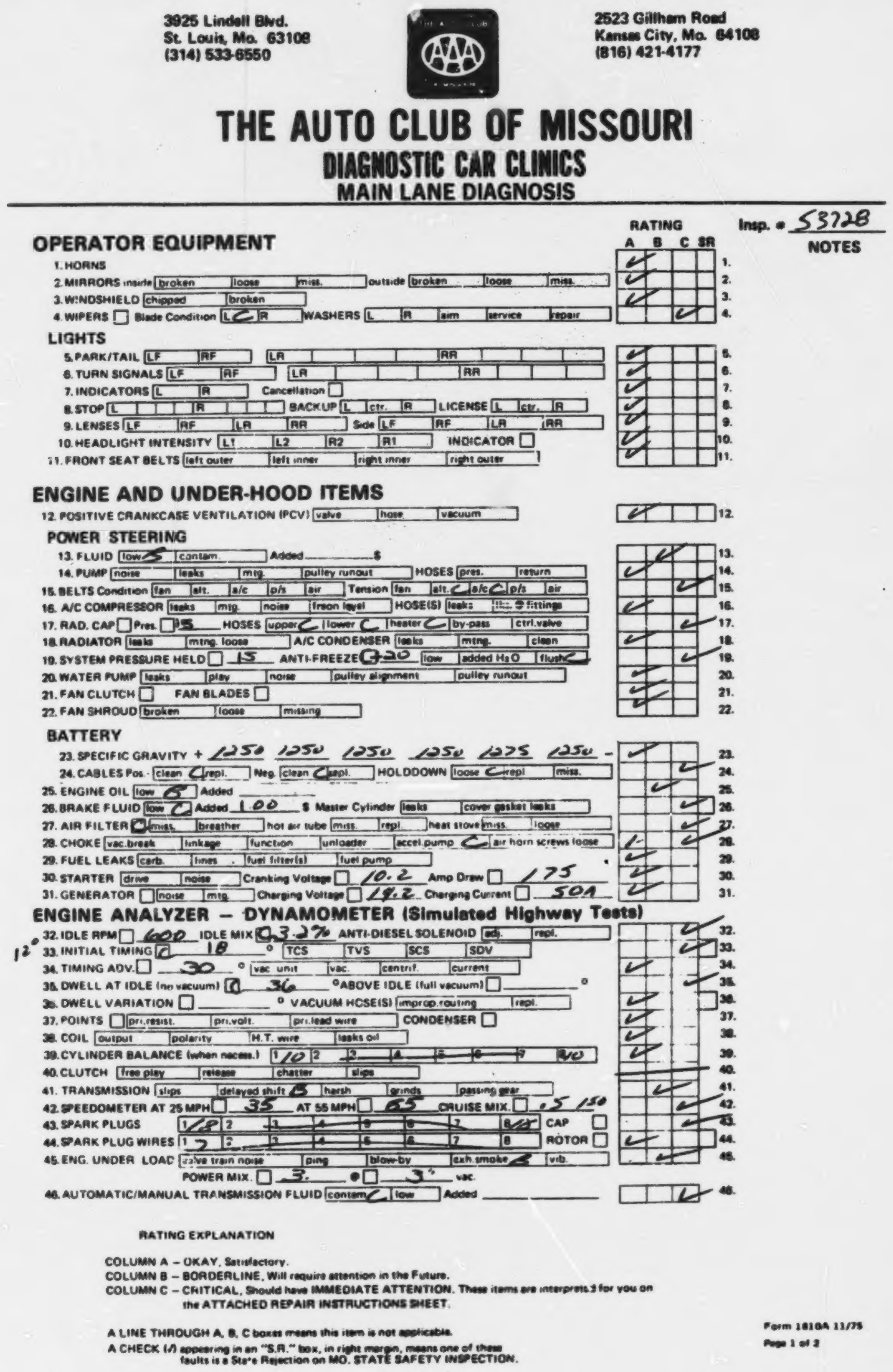
Form No. 1804 REV. 11-73

Remember: You must provide us with a repair invoice from your repair facility in order for us to carry out a recheck inspection.

WHITE — CUSTOMER COPY
CANARY — CLINIC COPY
PINK — GARAGE COPY

FIGURE 12. SUMMARY OF RECOMMENDATIONS FOR REPAIRS

BEST DOCUMENT AVAILABLE



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THE AUTO CLUB OF MISSOURI
DIAGNOSTIC CAR CLINICS
MAIN LANE DIAGNOSIS

Insp. # 53728

NOTES

OPERATOR EQUIPMENT

RATING	A	B	C	SR	
1. HORNS	✓				1.
2. MIRRORS inside ☐ broken ☐ loose ☐ miss. outside ☐ broken ☐ loose ☐ miss.	✓				2.
3. WINDSHIELD ☐ chipped ☐ broken	✓				3.
4. WIPERS ☐ Blade Condition L C R WASHERS ☐ L ☐ R ☐ aim ☐ service ☐ repair			✓		4.

LIGHTS

	A	B	C	SR	
5. PARK/TAIL LF RF LR RR	✓				5.
6. TURN SIGNALS LF RF LR RR	✓				6.
7. INDICATORS L R Cancellation ☐	✓				7.
8. STOP L R BACKUP L ctr. R LICENSE L ctr. R	✓				8.
9. LENSES LF RF LR RR Side LF RF LR RR	✓				9.
10. HEADLIGHT INTENSITY L1 L2 R2 R1 INDICATOR ☐	✓				10.
11. FRONT SEAT BELTS left outer left inner right inner right outer	✓				11.

ENGINE AND UNDER-HOOD ITEMS

	A	B	C	SR	
12. POSITIVE CRANKCASE VENTILATION (PCV) valve hose vacuum	✓				12.

POWER STEERING

	A	B	C	SR	
13. FLUID low S contam. Added ________ $		✓			13.
14. PUMP noise leaks mtg. pulley runout HOSES pres. return	✓				14.
15. BELTS Condition fan alt. a/c p/s air Tension fan alt. C a/c C p/s air			✓		15.
16. A/C COMPRESSOR leaks mtg. noise freon level HOSE(S) leaks [illegible] fittings	✓				16.
17. RAD. CAP ☐ Pres. ☐ 15 HOSES upper C lower C heater C by-pass ctrl.valve			✓		17.
18. RADIATOR leaks mtng. loose A/C CONDENSER leaks mtng. clean	✓				18.
19. SYSTEM PRESSURE HELD ☐ 15 ANTI-FREEZE C -20 low added H_2O flush C			✓		19.
20. WATER PUMP leaks play noise pulley alignment pulley runout	✓				20.
21. FAN CLUTCH ☐ FAN BLADES ☐	✓				21.
22. FAN SHROUD broken loose missing	✓				22.

BATTERY

	A	B	C	SR	
23. SPECIFIC GRAVITY + 1250 1250 1250 1250 1275 1250 -	✓				23.
24. CABLES Pos. clean C repl. Neg. clean C repl. HOLDDOWN loose C repl miss.			✓		24.
25. ENGINE OIL low B Added ________		✓			25.
26. BRAKE FLUID low C Added 1.00 $ Master Cylinder leaks cover gasket leaks			✓		26.
27. AIR FILTER C miss. breather hot air tube miss. repl. heat stove miss. loose			✓		27.
28. CHOKE vac.break linkage function unloader accel.pump C air horn screws loose	1-		✓		28.
29. FUEL LEAKS carb. lines fuel filter(s) fuel pump	✓				29.
30. STARTER drive noise Cranking Voltage ☐ 10.2 Amp Draw ☐ 175	✓				30.
31. GENERATOR ☐ noise mtg. Charging Voltage ☐ 14.2 Charging Current ☐ 50A	✓				31.

ENGINE ANALYZER — DYNAMOMETER (Simulated Highway Tests)

	A	B	C	SR	
32. IDLE RPM ☐ 600 IDLE MIX C 3.2% ANTI-DIESEL SOLENOID adj. repl.			✓		32.
12° 33. INITIAL TIMING C 18 ° TCS TVS SCS SDV			✓		33.
34. TIMING ADV. ☐ 30 ° vac unit vac. centrif. current	✓				34.
35. DWELL AT IDLE (no vacuum) C 36 ° ABOVE IDLE (full vacuum) ☐ ________ °			✓		35.
36. DWELL VARIATION ☐ ________ ° VACUUM HOSE(S) improp.routing repl.	✓				36.
37. POINTS ☐ pri.resist. pri.volt. pri.lead wire CONDENSER ☐	✓				37.
38. COIL output polarity H.T. wire leaks oil	✓				38.
39. CYLINDER BALANCE (when necess.) 1 10 2 ~~3 4 5 6 7~~ 8 10	✓				39.
40. CLUTCH free play release chatter slips	—	—	—		40.
41. TRANSMISSION slips delayed shift B harsh grinds passing gear		✓			41.
42. SPEEDOMETER AT 25 MPH ☐ 35 AT 55 MPH ☐ 65 CRUISE MIX. ☐ .5 150			✓		42.
43. SPARK PLUGS 1 /8 2 ~~3 4 5 6 7~~ 8 /8 CAP ☐			✓		43.
44. SPARK PLUG WIRES 1 2 2 ~~3 4 5 6 7~~ 8 ROTOR ☐	✓				44.
45. ENG. UNDER LOAD valve train noise ping blow-by exh.smoke B vib. POWER MIX. ☐ 3. @ ☐ 3" vac.		✓			45.
46. AUTOMATIC/MANUAL TRANSMISSION FLUID contam C low Added ________			✓		46.

RATING EXPLANATION

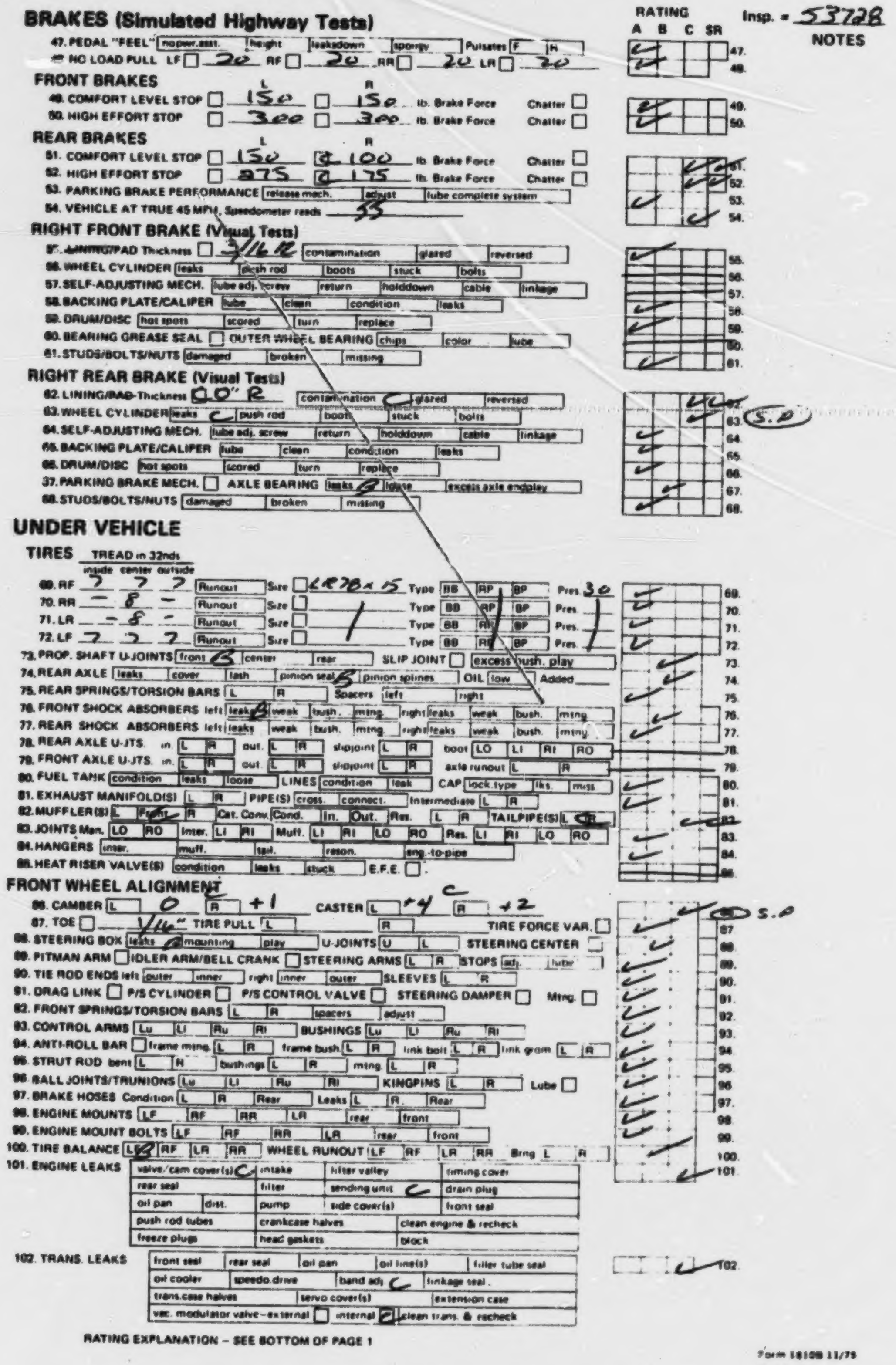
COLUMN A – OKAY, Satisfactory.
COLUMN B – BORDERLINE, Will require attention in the Future.
COLUMN C – CRITICAL, Should have IMMEDIATE ATTENTION. These items are interpreted for you on the ATTACHED REPAIR INSTRUCTIONS SHEET.

A LINE THROUGH A, B, C boxes means this item is not applicable.
A CHECK (✓) appearing in an "S.R." box, in right margin, means one of these faults is a State Rejection on MO. STATE SAFETY INSPECTION.

Form 1810A 11/75
Page 1 of 2

FIGURE 13. COMPLETED MAIN LANE DIAGNOSTIC CHECKLIST

BEST DOCUMENT AVAILABLE



BRAKES (Simulated Highway Tests)

RATING A B C SR

Insp. # 53728

NOTES

47. PEDAL "FEEL" no pwr. asst. | height | leakdown | spongy | Pulsates F R
48. NO LOAD PULL LF ☐ 20 RF ☐ 20 RR ☐ 20 LR ☐ 20

FRONT BRAKES L R

49. COMFORT LEVEL STOP ☐ 150 ☐ 150 lb. Brake Force Chatter ☐
50. HIGH EFFORT STOP ☐ 300 ☐ 300 lb. Brake Force Chatter ☐

REAR BRAKES L R

51. COMFORT LEVEL STOP ☐ 150 ☑ 100 lb. Brake Force Chatter ☐
52. HIGH EFFORT STOP ☐ 275 ☑ 175 lb. Brake Force Chatter ☐
53. PARKING BRAKE PERFORMANCE release mech. | adjust | lube complete system
54. VEHICLE AT TRUE 45 MPH, Speedometer reads 53

RIGHT FRONT BRAKE (Visual Tests)

55. ~~LINING~~/PAD Thickness ☐ 3/16 R contamination | glazed | reversed
56. WHEEL CYLINDER leaks | push rod | boots | stuck | bolts
57. SELF-ADJUSTING MECH. lube adj. screw | return | holddown | cable | linkage
58. BACKING PLATE/CALIPER lube | clean | condition | leaks
59. DRUM/DISC hot spots | scored | turn | replace
60. BEARING GREASE SEAL ☐ OUTER WHEEL BEARING chips | color | lube
61. STUDS/BOLTS/NUTS damaged | broken | missing

RIGHT REAR BRAKE (Visual Tests)

62. LINING/~~PAD~~-Thickness 0.0" R contamination C | glazed | reversed
63. WHEEL CYLINDER leaks C | push rod | boots | stuck | bolts (S.D)
64. SELF-ADJUSTING MECH. lube adj. screw | return | holddown | cable | linkage
65. BACKING PLATE/CALIPER lube | clean | condition | leaks
66. DRUM/DISC hot spots | scored | turn | replace
67. PARKING BRAKE MECH. ☐ AXLE BEARING leaks B | loose | excess axle endplay
68. STUDS/BOLTS/NUTS damaged | broken | missing

UNDER VEHICLE

TIRES TREAD in 32nds

	inside	center	outside					
69. RF	7	7	7	Runout	Size ☐ LR78×15	Type BB RP BP	Pres. 30
70. RR	–	8	–	Runout	Size ☐ |	Type BB RP BP	Pres. |
71. LR	–	8	–	Runout	Size ☐ |	Type BB RP BP	Pres. |
72. LF	7	7	7	Runout	Size ☐ |	Type BB RP BP	Pres. |

73. PROP. SHAFT U-JOINTS front B | center | rear SLIP JOINT ☐ excess bush. play
74. REAR AXLE leaks | cover | lash | pinion seal B | pinion splines OIL low Added ____
75. REAR SPRINGS/TORSION BARS L | R Spacers left | right
76. FRONT SHOCK ABSORBERS left leaks B | weak | bush. | mtng. right leaks | weak | bush. | mtng.
77. REAR SHOCK ABSORBERS left leaks | weak | bush. | mtng. right leaks | weak | bush. | mtng.
78. REAR AXLE U-JTS. in. L R out. L R slipjoint L R boot LO LI RI RO
79. FRONT AXLE U-JTS. in. L R out. L R slipjoint L R axle runout L R
80. FUEL TANK condition | leaks | loose LINES condition | leak CAP lock.type | lks. | miss
81. EXHAUST MANIFOLD(S) L | R PIPE(S) cross. | connect. Intermediate L | R
82. MUFFLER(S) L | Front C | R Cat. Conv. Cond. | In. | Out. Res. L | R TAILPIPE(S) L C R
83. JOINTS Man. LO | RO Inter. LI | RI Muff. LI | RI | LO | RO Res. LI | RI | LO | RO
84. HANGERS inter. | muff. | tail. | reson. | eng.-to-pipe
85. HEAT RISER VALVE(S) condition | leaks | stuck E.F.E. ☐

FRONT WHEEL ALIGNMENT

86. CAMBER L 0 C R +1 CASTER L +4 C R +2 S.D
87. TOE ☐ 1/16" TIRE PULL L R TIRE FORCE VAR. ☐
88. STEERING BOX leaks B | mounting | play U-JOINTS U | L STEERING CENTER ☐
89. PITMAN ARM ☐ IDLER ARM/BELL CRANK ☐ STEERING ARMS L | R STOPS adj. | lube
90. TIE ROD ENDS left outer | inner right inner | outer SLEEVES L | R
91. DRAG LINK ☐ P/S CYLINDER ☐ P/S CONTROL VALVE ☐ STEERING DAMPER ☐ Mtng. ☐
92. FRONT SPRINGS/TORSION BARS L | R | spacers | adjust
93. CONTROL ARMS Lu | Ll | Ru | Rl BUSHINGS Lu | Ll | Ru | Rl
94. ANTI-ROLL BAR ☐ frame mtng. L | R frame bush. L | R link bolt L | R link grom L | R
95. STRUT ROD bent L | R bushings L | R mtng. L | R
96. BALL JOINTS/TRUNIONS Lu | Ll | Ru | Rl KINGPINS L | R Lube ☐
97. BRAKE HOSES Condition L | R | Rear Leaks L | R | Rear
98. ENGINE MOUNTS LF | RF | RR | LR | rear | front
99. ENGINE MOUNT BOLTS LF | RF | RR | LR | rear | front
100. TIRE BALANCE LF B | RF | LR | RR WHEEL RUNOUT LF | RF | LR | RR Brng L | R

101. ENGINE LEAKS

valve/cam cover(s) C	intake	lifter valley	timing cover
rear seal	filter	sending unit C	drain plug
oil pan / dist.	pump	side cover(s)	front seal
push rod tubes	crankcase halves	clean engine & recheck	
freeze plugs	head gaskets	block	

102. TRANS. LEAKS

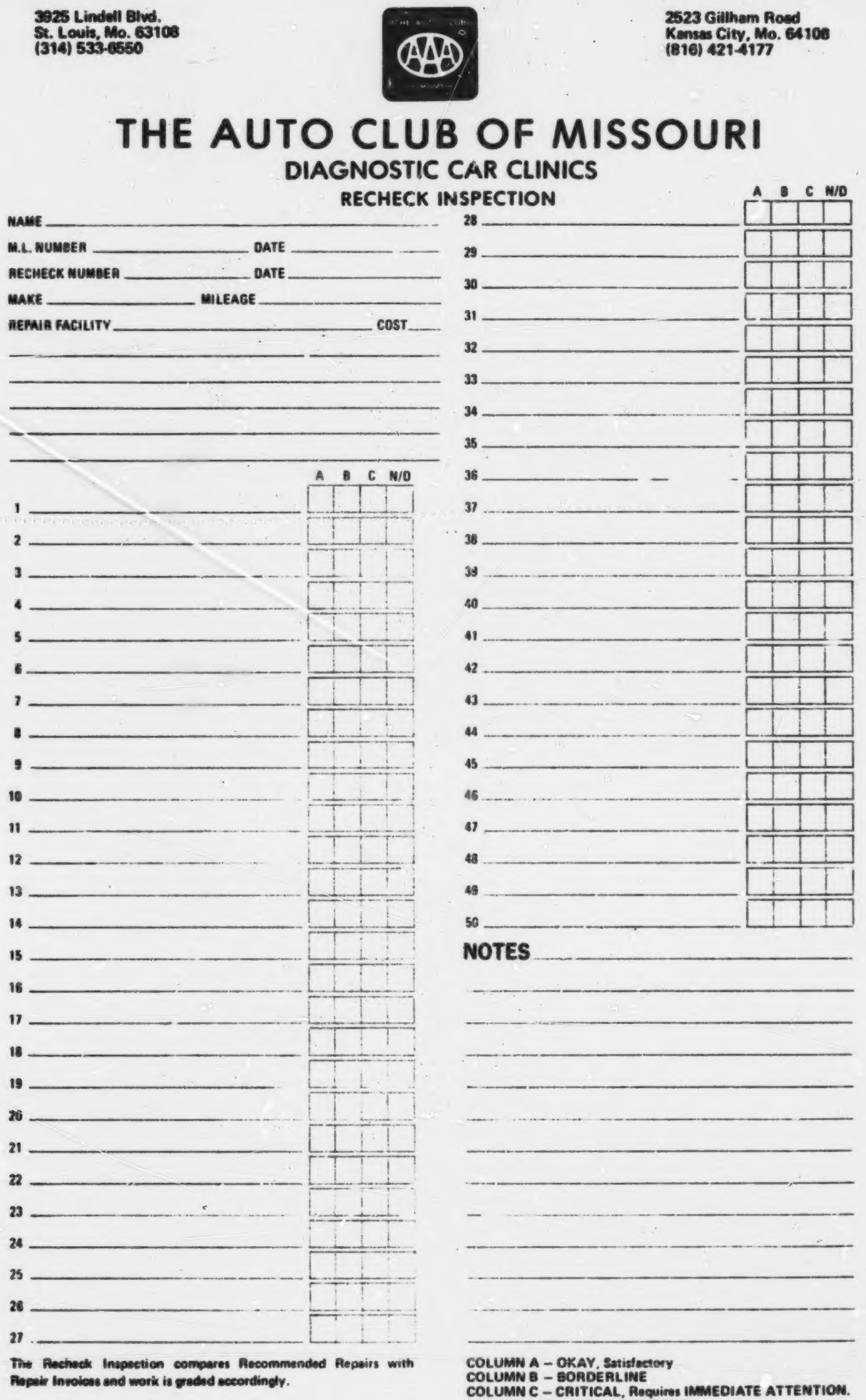
front seal	rear seal	oil pan	oil line(s)	filler tube seal
oil cooler	speedo.drive	band adj. C	linkage seal.	
trans.case halves	servo cover(s)	extension case		
vac. modulator valve–external ☐	internal ☑	clean trans. & recheck		

RATING EXPLANATION – SEE BOTTOM OF PAGE 1

Form 1810B 11/75
Page 2 of 2

FIGURE 13. COMPLETED MAIN LANE DIAGNOSTIC CHECKLIST (CONTINUED)

BEST DOCUMENT AVAILABLE



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THE AUTO CLUB OF MISSOURI
DIAGNOSTIC CAR CLINICS
RECHECK INSPECTION

NAME ____________________
M.L. NUMBER ____________ DATE ____________
RECHECK NUMBER ____________ DATE ____________
MAKE ____________ MILEAGE ____________
REPAIR FACILITY ____________ COST ______

		A	B	C	N/D
1	____	☐	☐	☐	☐
2	____	☐	☐	☐	☐
3	____	☐	☐	☐	☐
4	____	☐	☐	☐	☐
5	____	☐	☐	☐	☐
6	____	☐	☐	☐	☐
7	____	☐	☐	☐	☐
8	____	☐	☐	☐	☐
9	____	☐	☐	☐	☐
10	____	☐	☐	☐	☐
11	____	☐	☐	☐	☐
12	____	☐	☐	☐	☐
13	____	☐	☐	☐	☐
14	____	☐	☐	☐	☐
15	____	☐	☐	☐	☐
16	____	☐	☐	☐	☐
17	____	☐	☐	☐	☐
18	____	☐	☐	☐	☐
19	____	☐	☐	☐	☐
20	____	☐	☐	☐	☐
21	____	☐	☐	☐	☐
22	____	☐	☐	☐	☐
23	____	☐	☐	☐	☐
24	____	☐	☐	☐	☐
25	____	☐	☐	☐	☐
26	____	☐	☐	☐	☐
27	____	☐	☐	☐	☐
28	____	☐	☐	☐	☐
29	____	☐	☐	☐	☐
30	____	☐	☐	☐	☐
31	____	☐	☐	☐	☐
32	____	☐	☐	☐	☐
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34	____	☐	☐	☐	☐
35	____	☐	☐	☐	☐
36	____	☐	☐	☐	☐
37	____	☐	☐	☐	☐
38	____	☐	☐	☐	☐
39	____	☐	☐	☐	☐
40	____	☐	☐	☐	☐
41	____	☐	☐	☐	☐
42	____	☐	☐	☐	☐
43	____	☐	☐	☐	☐
44	____	☐	☐	☐	☐
45	____	☐	☐	☐	☐
46	____	☐	☐	☐	☐
47	____	☐	☐	☐	☐
48	____	☐	☐	☐	☐
49	____	☐	☐	☐	☐
50	____	☐	☐	☐	☐

NOTES ____________________

The Recheck Inspection compares Recommended Repairs with Repair Invoices and work is graded accordingly.

Form 1 613 Clinic Recheck—Rev. 5/76

COLUMN A – OKAY, Satisfactory
COLUMN B – BORDERLINE
COLUMN C – CRITICAL, Requires IMMEDIATE ATTENTION.
COLUMN N/D – WORK NOT DONE.

FIGURE 14. RECHECK RESULTS FORM

BEST DOCUMENT AVAILABLE

AUTO CLUB CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address:
Ontario Motor League
Toronto Club
Car Inspection Centre
142 Vanderhoof Avenue
Toronto, Ontario M4G 4C2

2. Contact Name and Phone Number:
George Connolly
Director of Technical Services
(416) 964-3170

3. General Description of Facility: The Car Inspection Centre supports a four-lane diagnostic inspection facility which provides diagnostic services for members only. Non-member vehicles are accepted only if no other facility can diagnose the problem. The Centre was opened in 1976 and has an area of 7,200 square feet.

4. Vehicle Types Inspected: Passenger cars, vans, and half-ton pick-ups are the types of vehicles inspected.

5. Types of Inspection Services: The Centre provides complete diagnostic testing of nearly 400 items, including dynamic brake testing, wheel alignment, engine analysis, and idle and loaded mode emissions analysis. Visual inspection of tires and wheels, steering and suspension, exhaust system, fuel system, transmission, and lights is included. A general inspection is also made of the glazing, windshield wipers condition, horn, seat belts, seats, doors and door locks and pedal movement play. Reinspection is available for a fee, as an option, on the repaired item. This reinspection would include the use of diagnostic equipment (dynamometer, engine analyzer, etc.) if necessary.

6. Hours of Operation:
M-F, 9:00 a.m. to 5:00 p.m.
Sat., 9:00 a.m. to 1:00 p.m.

[redacted]

7. Physical Area of Inspection Facility: 7,200 square feet, of which approximately 675 square feet are set aside for a reception area, a customer waiting area, and an office area. Additionally, an area of approximately 295 square feet is used as a storage area, an equipment area, and a staff comfort area. (See Figure 1.)

8. Inspection Station Dimensions: Approximately 6,230 square feet of the facility are available for vehicle inspection. Of this area, approximately 690 square feet cannot be used effectively for inspection because of the configuration of the offices, waiting room and other accommodations.

9. Number of Lanes/Bays: Four.

10. Lane Dimensions: Two lanes have the dimensions of 120' x 15'. Two lanes have approximately the dimensions of 60' x 15'.

11. Queueing Area: There is no queueing area. The inspections are conducted by appointment only.

12. Parking Area: There are parking facilities for 50 vehicles immediately outside the facility.

13. Facility Diagram and Location of Equipment: See Figure 1.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Built: The Centre was opened in an existing building which was modified in 1975.

2. Construction Type: Cement block.

3. Patron Accommodations in Addition to Lanes: The customer waiting and reception area can accommodate 25 people.

4. Ventilation System Design: Auxiliary fans are used to ventilate the lanes. In addition, louvered exhaust systems are used at the dynamometer and exhaust system test stations.

5. Safety Accommodations: Safety glass separates the reception area and vehicle inspection lanes. Ministry of Labor safety standards are met.

BEST DOCUMENT AVAILABLE

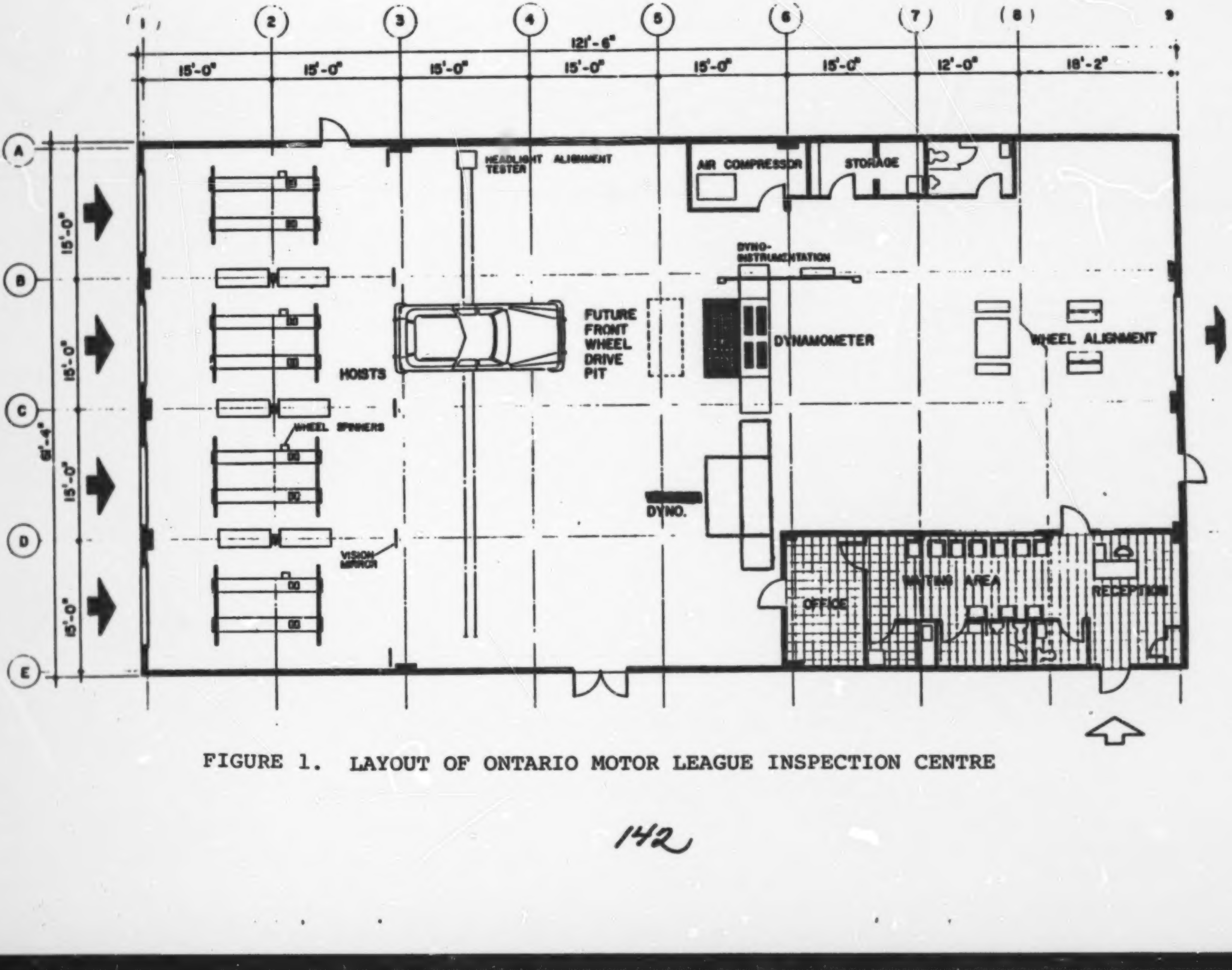

1
2
3
4
5
6
7
8
9
121'-6"
15'-0"
15'-0"
15'-0"
15'-0"
15'-0"
15'-0"
12'-0"
18'-2"
A
B
C
D
E
15'-0"
15'-0"
15'-0"
15'-0"
61'-4"
HEADLIGHT ALIGNMENT TESTER
AIR COMPRESSOR
STORAGE
DYNO-INSTRUMENTATION
FUTURE FRONT WHEEL DRIVE PIT
DYNAMOMETER
WHEEL ALIGNMENT
HOISTS
WHEEL SPINNERS
DYNO.
VISION MIRROR
OFFICE
WAITING AREA
RECEPTION

FIGURE 1. LAYOUT OF ONTARIO MOTOR LEAGUE INSPECTION CENTRE

6. Noise Accommodations: The dynamometers are equipped with sound-deadening rolls. The safety glass partitions also minimize noise in the customer reception area.

III. STEPS OF INSPECTION PROCESS

1. Check-In: The customer fills out a check-in form in the reception area.

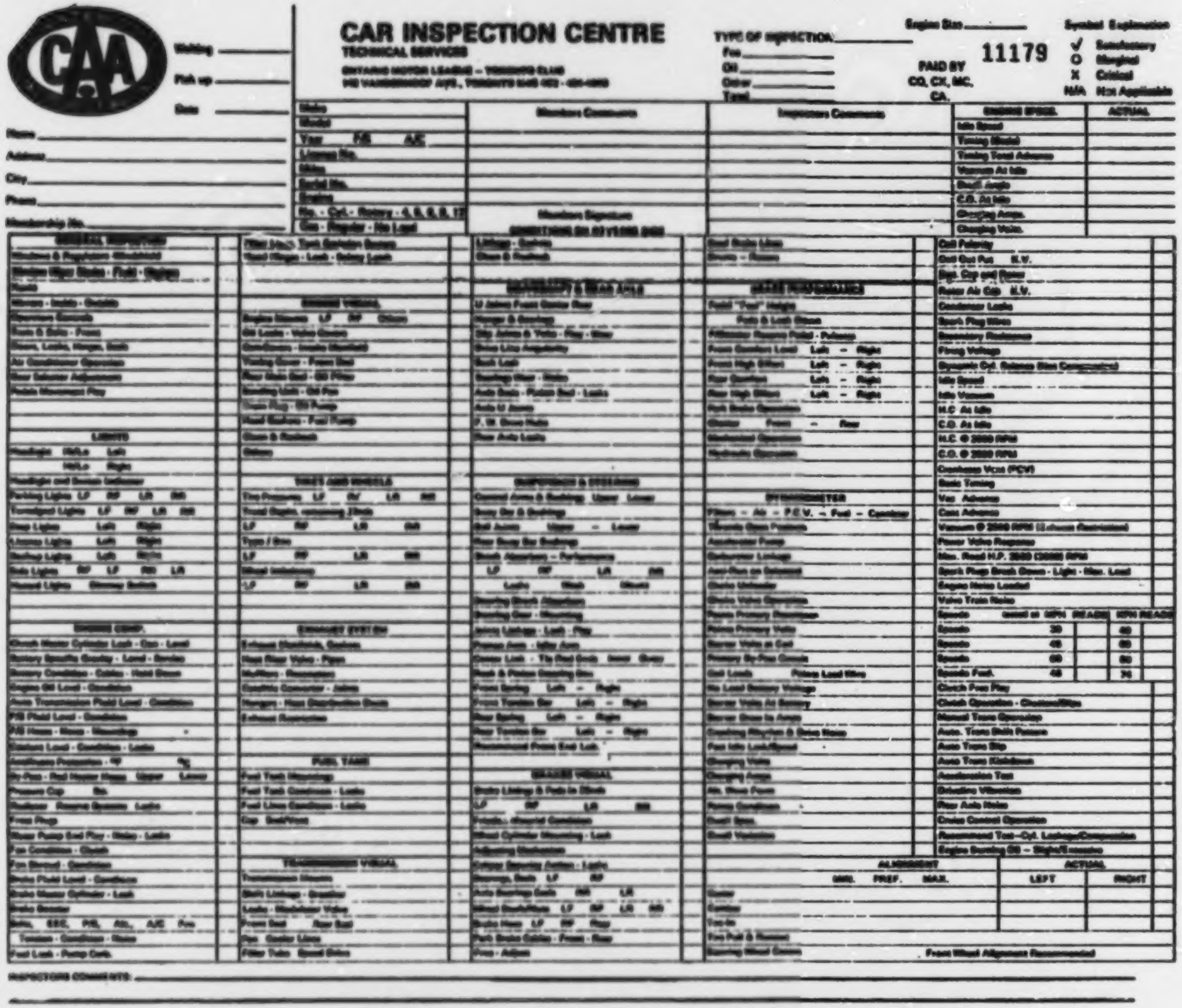
2. Test Sequence: The Centre inspects approximately 400 items in the following sequence:

    - Operator equipment
    - Lights
    - Engine compartment
    - Brakes (pull all four wheels for a visual check of brake linings, pads)
    - Suspension and steering
    - Shock absorbers
    - Tires and wheels
    - Exhaust (readings on HC, CO)
    - Fuel tank
    - Engine (visual check)
    - Transmission (visual check)
    - Drive shaft and rear axle
    - Brake performance test
    - Alignment.

3. Data Handling: The inspector completes a manual checksheet as each inspection is completed. See Figure 2.

[redacted]

BEST DOCUMENT AVAILABLE



CAR INSPECTION CENTRE
TECHNICAL SERVICES

Name
Address
City
Phone
Membership No.
Date

TYPE OF INSPECTION
Fee
Oil
Other
Total

Engine Size

PAID BY
CO, CX, MC,
CA.

11179

Symbol Explanation
✓ Satisfactory
O Marginal
X Critical
N/A Not Applicable

Members Comments
Inspectors Comments
ACTUAL

FIGURE 2. ONTARIO MOTOR LEAGUE DIAGNOSTIC CHECKSHEET

4. Check-Out: A debriefing of inspection findings and required remedies is given by a technical advisor after the inspection. The debriefing sessions last 5-30 minutes, depending on the depth of the problems and the questions asked. A copy of the diagnostic checksheet is given to the motorist as a means of informing the repair facility.

IV. FEES

1. Diagnostic Inspection: $38.50 (members)
   $44.00 (non-members)

2. Other Services: Reinspection, $10.00 for members. If a customer wishes to have just a specific item checked, the charge is according to the mechanic's hourly retail rate ($20.00 in 1980). The cooling system, automatic transmission and brakes are all part of the diagnostic check. No repairs are performed.

V. TEST EQUIPMENT

1. Brakes: (Two) Combination Clayton Brake Analyzer/Dynamometers DB8-CP200.

2. Alignment: (One) Hunter Dynamic Front End Analyzer F-60.

3. Headlight Aim: (One) Hoffman Headlight Tester.

4. Lifts: (Four) lifts, including three Bradbury 4-pillar hoists, and one Vulcan 2-pillar hoist.

5. Emissions Analyzer: (One) Clayton Infrared Exhaust Gas Analyzer and (three) Sun EPA 75 HC/CO exhaust analyzers are available. Four emissions analyzers are used to provide back-up when gas filters become clogged.

6. Engine Analyzer: (One) Sun 947 Engine Analyzer, (one) Clayton 7100 Engine Analyzer, (three) Sun 1115 Engine Analyzers.

7. Dynamometer: (Two) Clayton DB8-CP200 Dynamometers and Brake Analyzers (same as brakes above).

8. Noise Testing: No sound level meters.

9. Fuel Economy: No instrumentation.

10. Other:

- One Sun cylinder leak detector
- One Pyrometer (measures engine temperature)
- Six Hunter wheel spinners
- Two Clayton H.P./MPH consoles
- One Devilbiss 22 c.f.m. compressor
- One Clayton engine analyzer console carrier
- One Sun BC 160 battery charger
- One Sun VAT 28 volt/amp. tester
- Eleven sets mechanic's hand tools
- One Techsonic ultrasonic detector
- One air conditioner leak detector.

11. Plans for Replacement: The equipment at the Centre is almost five years old. They are planning to update the engine analyzers with an FMC Autoscan. The Autoscan will be evaluated in late 1980 and may be included in next year's budget.

12. Technical Library: The technical library contains both maintenance manuals for mechanics and auto care brochures for consumers. Typical of both are the following:

- Chilton's Annual Service Manual and Labor Guide
- Mitchell Autobody and Labor Guide
- Service Manuals of Manufacturers - 1965 to date (imports and domestics)
- Chek Chart Annual Car Care Guide
- Consumer Reports
- Fuel Consumption Guides - 1978-1980
- Brochures such as Ontario Consumer Info: Transmission Trouble; Ontario Consumer Info: Car Repairs; Operation Tune-Up.

13. Mobile Equipment: The Centre has no mobile equipment.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: The air compressor is checked daily. The hoists and dynamometer are inspected weekly. The front end analyzer is calibrated monthly.

2. Frequency of Gas Calibration for Emissions Analyzers: Both the Clayton Infrared and Sun EPA-75 are calibrated weekly by the mechanics.

VII. FACILITY STAFFING

1. Program Director: George Connolly, Director of Technical Services.

2. Station Manager: One.

3. Chief Inspector: One.

4. Master Mechanics:* Nine.

5. Diagnosticians: One technical advisor.

6. Aides: None.

7. Clerical: Two receptionists.

8. Other: None.

VIII. TRAINING

1. Inspector Experience Requirements: Typically, the inspectors must have at least five years auto mechanic experience. Outstanding applicants with only three years of repair experience but appreciable knowledge are also considered. All the inspectors are licensed and certified mechanics under the statutes of the Canadian "Apprenticeship and Tradesman Act."

2. Employee Training Provisions: In-service training is provided at weekly staff meetings and at equipment manufacturers seminars.

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* Inspections are performed by master mechanics.

3. Technical Update Meetings: Training sessions are arranged with automobile and equipment manufacturers. Almost every week some type of local training seminar is available. Inspectors attend seminars on a rotating basis and report back to the diagnostic staff in weekly meetings. Meetings after work are called for special topics, such as recalls.

IX. QUALITY CONTROL

1. Supervision for Inspectors: The manager has service manager experience. The chief inspector was promoted from the level of master mechanic after gaining operational experience.

2. Surveys of Customer Satisfaction: The management occasionally distributes survey forms to customers and tabulates them manually. The estimated complaint ratio is 4 out of 1,000 customers.

3. Criteria for Failure: The Centre uses Ministry of Transport safety standards* plus Ontario Motor Club "rules of thumb" for determining vehicle pass/fail status.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Reinspection is available as an option within 30 days following repair. The charge ranges from $7.00 to $10.00. ($10.00 if the retest is on the dynamometer).

XI. CUSTOMER INTERFACE

1. Counseling: A technical advisor counsels customers on the problem areas found during inspection. The inspector does not recommend the use of any particular repair facility. He will estimate the cost of the repair if asked.

   Additional Customer Services/Accommodations: The counseling is performed in a comfortable, private area. The Centre also has a reception area and a waiting area for customers.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: Approximately 1.5 to 2 hours.

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* Ontario Ministry of Transport and Communication, "Motor Vehicle Inspection Station Manual." This manual is available for reference by the inspectors.

2. Time at Each Station in the Lane: The longest portion (75 percent) of the inspection is the vehicle inspection on the hoist. This takes approximately one hour for most cars and up to 1½ hours for older cars. The dynamic brake test and front end alignment test take ½ hour.

3. Theoretical Maximum Lane Throughput: The maximum throughput is nearly six cars per hour for the entire facility, or 45 cars per day.

4. Average Lane Throughput: The Centre currently handles 41 vehicles per day. (4.1 vehicles per inspector per day for 10 inspectors).

5. Appointments Used: Yes.

6. Busiest Time of Year: Spring months.

7. Maximum Number of Vehicles Processed:

In 1980, the Centre handled 10,120 vehicles.

XIII. CONSUMER AND COMMUNITY RELATIONS

No formal process has been established to enhance community or consumer relations. The Centre is responsive, however, to the enquiries of all consumers and consumer interest groups.

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Equipment Investment: Approximately $198,000 was invested in test equipment at the facility start-up time (1976). The cost of the equipment (and installation) at the time of purchase is listed in Table 1.

TABLE 1. COST OF EQUIPMENT AT CAR INSPECTION CENTRE*

	DESCRIPTION	PURCHASE PRICE INC. INSTALLATION
3	Bradbury 4 pillar hoists	$ 9,600.
1	Vulcan 2 pillar hoist	3,000.
6	Hunter wheel spinners	4,680.
1	Hoffman headlight tester	800.
2	Clayton DB8 CO200 dynamometers and brake analyzers with 2 louvre exhaust systems including dynamometer and exhaust system pits and electrical supply	90,460.
1	Exhaust fan - dynamometer	2,188.
2	Clayton H.P./M.P.H. console Devilbiss 22 c.f.m. compressor	1,600. 1,800.
1	Sun 947 engine analyzer	10,200.
1	Clayton 7,100 engine analyzer and console carrier	10,318.
1	Clayton infra red exhaust gas analyzer	2,940.
3	Sun TUT 1115 engine analyzer	5,000. each
1	Sun BC 160 battery charger	545.
1	Sun VAT 28 volt/amp. tester	895.
1	Sun 75 HC/CO exhaust analyzer	800.
1	Hunter F-60 dynamic wheel alignment analyzer including pits and electrical supply	29,010.
11	Mechanics hand tools and cabinets	11,000.
1	Techsonic ultrasonic detector	460.
1	Sun cylinder leak detector	300.
1	Air conditioner leak detector	180.
2	Auxiliary floor fans	250.
		$186,026.

* 1976 Costs.

2. Average Hourly Labor Rate: Mechanic's retail rate is $20.00/hour. The salary for mechanics is about $9.00/hr.

3. Total Annual Operating Cost:

1980 total revenues	$360,000
1980 total expenses	394,000
1980 net loss	$ 34,000

4. Other Operating Costs: In 1980, the advertising budget was $7,500. Of this, $5,900 was spent primarily in advertising in the Canadian Motorist Magazine.

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AUTO CLUB CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: British Columbia Auto Association
Vehicle Inspection Service
999 West Broadway
Vancouver, British Columbia

2. Contact Name and Phone Number: Ambrose Kroetsch
Technical Director
(604) 732-3911
Don McVicker,
Manager of Technical Services

3. General Description of Facility: Currently, services are conducted out of five mobile units located throughout British Columbia. A new stationary facility (located near BCAA headquarters on W. Broadway) will be opening in Spring 1981. This inspection center will have an area of 10,000 square feet and will include all new equipment costing nearly $200,000. The information in this summary addresses the new center.

4. Vehicle Types Inspected: At the mobile units, the maximum allowable vehicle weight is 8,000 pounds. Passenger cars, pickups, light trucks and diesels will be inspected at the new diagnostic center facility. Large trucks and motorcycles will probably not be included.

5. Type of Inspection Services: The mobile units offer a limited engine and safety inspection for motorists who are buying a new car or are planning to take a long trip. The new facility will offer diagnostic inspection services.

6. Hours of Operation: M-F, 8:00 a.m. to 5:00 p.m.

7. Physical Area of Inspection Facility: New facility, 10,000 square feet.

8. Inspection Station Dimensions: 100' x 100'; including office space, technical services and library.

9. Number of Lanes/Bays: Three areas converge on a single dynamometer and engine analyzer in a wide lane.

10. Lane Dimensions: The main drive-through lane is 100 feet long and 45 feet wide. Each hoist area is approximately 9 feet wide.

11. Queueing Area: A 12-foot-wide queueing lane outside the building.

12. Parking Area: A parking area to the east of the building can accommodate 50 vehicles.

13. Facility Diagram and Location of Equipment: See Figure 1.*

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Built: 1980.

2. Construction Type: Cement Block.

3. Patron Accommodations in Addition to Lanes: A counseling area is provided. The inspection process can be viewed from a glassed-in walkway, similar to walking alongside a car wash.

4. Ventilation System Design: Clayton exhaust louvers behind dynamometer.

5. Safety Accommodations: Safety glass is provided in the viewing area. The Ministry of Labor (Canada's equivalent to OSHA) safety standards must be met. There will be two people trained in industrial first aid at the center at all times.

6. Noise Accommodations: Dynamometers will probably be equipped with sound deadening rolls.

III. STEPS OF INSPECTION PROCESS

1. Check-In: Vehicle identification data will be entered at a computer terminal.

2. Test Sequence: The inspection includes a total visual inspection, a wheel alignment test, a compression balance test, and an Autosense check for exhaust.

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* Detailed architectural plans not available.

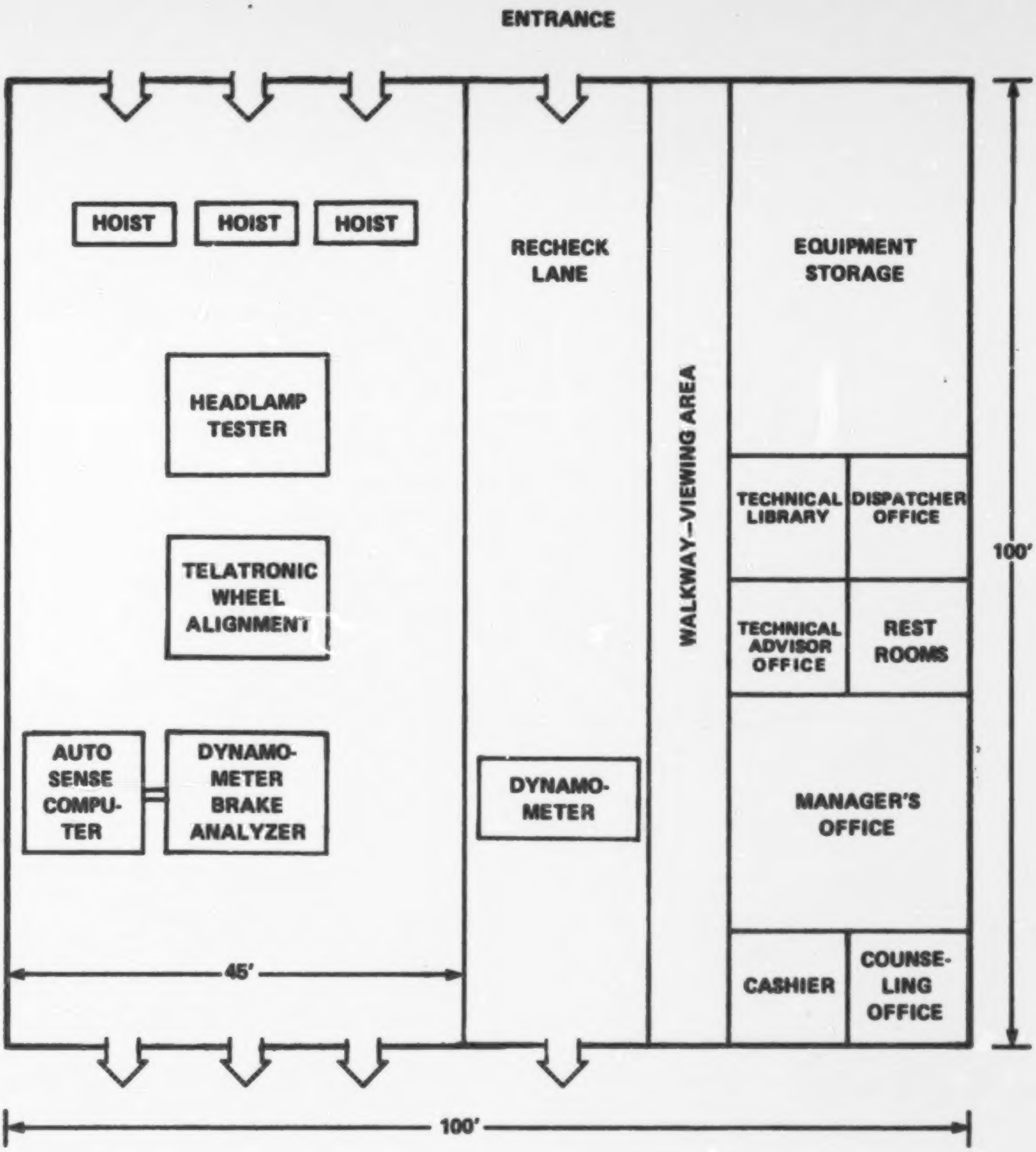
ENTRANCE
HOIST
HOIST
HOIST
RECHECK LANE
EQUIPMENT STORAGE
WALKWAY–VIEWING AREA
HEADLAMP TESTER
TECHNICAL LIBRARY
DISPATCHER OFFICE
100'
TELATRONIC WHEEL ALIGNMENT
TECHNICAL ADVISOR OFFICE
REST ROOMS
AUTO SENSE COMPUTER
DYNAMOMETER BRAKE ANALYZER
DYNAMOMETER
MANAGER'S OFFICE
45'
CASHIER
COUNSELING OFFICE
100'

FIGURE 1. LAYOUT OF BRITISH COLUMBIA AUTO ASSOCIATION INSPECTION STATION

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3. Data Handling: Results of each diagnostic test will be entered into the terminal. The dynamometer will print out its results separately.

4. Check-Out: Customer is given a two-page computer printout. The first page lists 101 vehicle items with an indication of their condition (OK or immediate action needed). The second page provides a description of the types of repairs that are needed.

IV. FEES

1. Diagnostic Inspection: $35.00 for members
   $40.00 for nonmembers

2. Other Services: Reinspection, $15.00
   System checks are charged at an hourly rate of $20.00.

V. TEST EQUIPMENT

1. Brakes: Combination Clayton Brake/Chassis Dynamometer DT-2-DB-8-200 (one).

2. Alignment: Bear Dual Control Telatronic Wheel Alignment Unit 64659.

3. Headlight Aim: Hunter Tractype Tester 25-36-2T.

4. Lift: Bradbury four-post hoists (three).

5. Engine Analyzer: Hamilton Test Autosense Unit 610CEA.

6. Dynamometer: Brake dynamometer (see Brakes).

7. Noise Testing: ESB, Inc., Wilson Sound Level Meter IN-19 with IN-17 calibrator.

8. Fuel Economy: Checked indirectly as part of Autosense engine analysis.

9. Other Equipment: The facility has mechanic hand tools.

[redacted]

10. Back-Up Provisions: A replacement for the Autosense is available if the one on the floor fails to function. An older Clayton dynamometer can handle any overflow of vehicles. It will also be used for reinspections.

11. Plans for Replacement: None.

12. Technical Library: The library includes:

    Subscriptions to Mitchell Manuals
    Motor Series of Publications
    Auto Repair Manual
    Auto Troubleshooter
    Manufacturers' update bulletins
    Consumer Reports magazine
    Road and Track magazine
    Car and Driver magazine
    Mechanics Illustrated magazine
    Service Station and Garage Management magazine
    Canadian Automotive Trade (CAT) magazine
    Pickup, Van and Four Wheel Drive.

13. Mobile Equipment: Five Gremlins and AMC Sprites that carry hand tools plus an engine analyzer are currently used to provide limited diagnostic services. Services provided by the mobile equipment include:

    - Automotive Testing Equipment: KAL Engine Analyzer 5005, 1¼ ton jack.

    - Vehicles Tested: The vehicle size limit is 8,000 pounds because of the jack capability.

    - Operational Features: The inspections conducted by the mobile units include tests of the following:

        - Charging system

        - Ignition

        - Cylinder balance

        - Visual inspection of brakes, wheels, suspension, lights, fuel system, exhaust system, transmission

        - Removal of the right front and right rear wheels to inspect brake linings

- Road test

. Mobile Unit Fees: $30.00 for members
$40.00 for nonmembers.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: Not established.
2. Frequency of Gas Calibration for Emissions Analyzer: Not yet determined.

VII. FACILITY STAFFING

1. Technical Director: Ambrose Kroetsch.
2. Manager of Technical Services: Don McVicker
3. Station Manager: Dave Stephenson.
4. Master Mechanics*: Five are planned.
5. Junior Mechanics : None.
6. Diagnosticians: None.
7. Aides: One cashier-dispatcher.
8. Clerical: One stenographer.
9. Other: Two counselors.

VIII. TRAINING

1. Inspector Experience Requirements: All inspectors must, at a minimum, be Provincially registered mechanics. Supervisors must have an understanding of the equipment plus administrative skills.
2. Employee Training Provisions: Courses are provided by the Vocational Institute in Vancouver. The courses address new vehicle technology and changing diagnostic techniques.
3. Technical Update Meetings: Not yet determined.

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* All inspections are performed by the master mechanics.

XI. QUALITY CONTROL

1. Supervision of Inspectors: Program director will supervise the mechanics while they perform the inspections.

2. Surveys or Studies of Customer Satisfaction: None planned.

3. Criteria for Failure: Manufacturers' specifications are available for reference by the mechanic inspectors.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

A reinspection can be performed up to ten days following repairs for a fee of $15.00.

XI. CUSTOMER INTERFACE

1. Counseling: An experienced counselor at the new inspection facility will explain both pages of the diagnostic inspection report. The counselor has access to a technical library. The counselor will provide a ball park estimate of repair costs if asked.

2. Additional Customer Services/Accommodations: A separate office to be used for counseling.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: Expected initial processing time is 85 minutes. The goal is to reach a 45-minute process time.

2. Time at Each Station in the Lane: Information not yet available.

3. Theoretical Maximum Throughput: The center plans to inspect 40 vehicles per day.

4. Average Lane Throughput: When it opens, the center expects to start out at about 27 cars per day, and then gradually increase throughput to 36-40 cars per day.

5. Appointments Used: Yes.

6. Busiest Time of Year: June-September is expected to be the busiest time of the year.

XIII. CONSUMER AND COMMUNITY RELATIONS

Not yet determined.

XIV. INVESTMENT AND OPERATING COSTS

Information not available as of Fall,1980.

AUTO CLUB CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: Montreal Club Diagnostic
Center
2718 Notre Dame West
Montreal, Quebec

2. Contact Name and Phone Number: Mr. H. McFadden
(514)288-7111, ext. 51

Mr. Gilbert Gagnon
(514)288-7111, ext. 25

3. General Description of Facility: The current facility was leased in 1978. Inspections were formerly conducted out of a mobile unit which became ineffective during winter months. Diagnostic services are available to club members only. The Montreal Auto Club facility is small when compared with facilities such as the Auto Club of Missouri or the new Keystone Auto Club. The principal testing equipment used in Montreal is an electronic engine analyzer and an optical headlight aimer.

4. Vehicle Types Inspected: Automobiles, trucks up to one-half ton.

5. Types of Inspection Services: The Center inspects approximately 100 vehicle items. An engine analysis and emissions analysis are performed. Brakes are inspected by wheel removal. Headlamp alignment is inspected by instrument. All other inspections of subsystems or components are by visual means or by a road test of the vehicle. Reinspection after repair is conducted for a fee. No repairs are performed.

6. Operating Hours: M-F, 8:30 a.m. to 5:00 p.m.

7. Physical Area of Inspection Facility: The Center inspection and office space is housed in an area of approximately 1000 square feet. The entire property is approximately 3500 square feet.

8. Inspection Station Dimensions: The area of inspection is approximately 24' x 25'.

9. Number of Lanes/Bays: Two bays comprise the inspection area of the facility.

10. Lane/Bay Dimensions: Each of the two bays is approximately 12' x 25'.

11. Queueing Area: Because of the limited vehicles inspected and the comparatively large parking area available, no queueing area is necessary.

12. Parking Area: 10-15 cars can be accommodated in the parking area outside the Center.

13. Facility Diagram and Location of Equipment: See Figure 1.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: The Center was previously a service station. It was adapted for diagnostic inspection use in 1978.

2. Construction Type and Material: Cement.

3. Patron Accommodations: There is a walled-off waiting room of approximately 180 square feet for patrons. They can observe the inspection process through windows.

4. Ventilation System Design: The office and patron waiting room are air conditioned. Exhaust hoses are attached to the vehicle tailpipes in the bays.

5. Safety Accommodations: Safety glass on windows used for viewing by patrons.

6. Noise Accommodations: None. The loudest sounds come from the airguns while lug nuts are being removed.

III. STEPS OF INSPECTION PROCESS

1. Check-In: Customer fills out an entrance form.

2. Sequence: A 100-point inspection process is followed, including:

   - Visual inspection, lights and headlamp aim

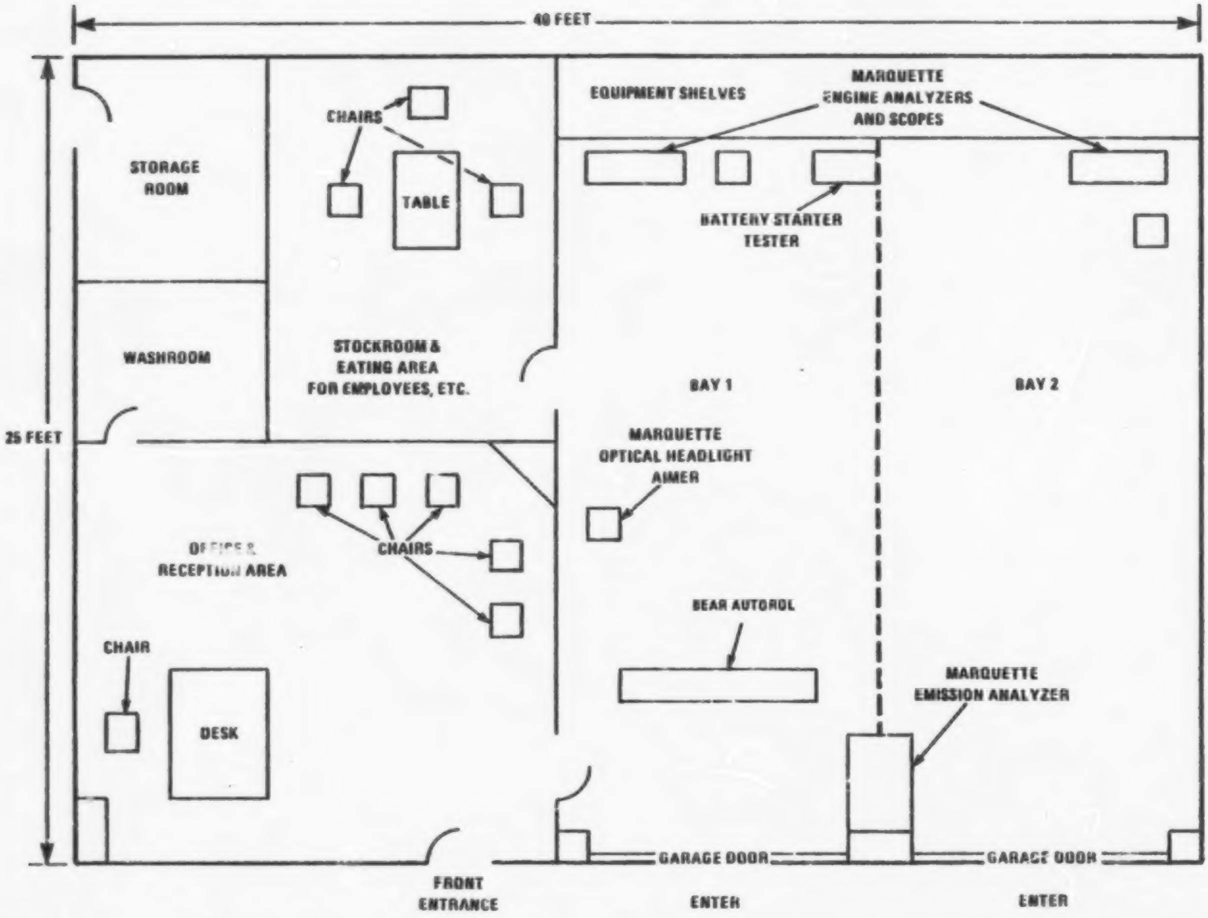
40 FEET
25 FEET
STORAGE ROOM
WASHROOM
CHAIRS
TABLE
STOCKROOM & EATING AREA FOR EMPLOYEES, ETC.
EQUIPMENT SHELVES
MARQUETTE ENGINE ANALYZERS AND SCOPES
BATTERY STARTER TESTER
BAY 1
BAY 2
MARQUETTE OPTICAL HEADLIGHT AIMER
CHAIRS
OFFICE & RECEPTION AREA
CHAIR
DESK
BEAR AUTOROL
MARQUETTE EMISSION ANALYZER
GARAGE DOOR
GARAGE DOOR
FRONT ENTRANCE
ENTER
ENTER

FIGURE 1. LAYOUT OF MONTREAL CLUB DIAGNOSTIC CENTER

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[redacted]

- Engine and emissions analysis, electrical system check
- Suspension check wheel pull (2 wheels)
- Road test(brakes are judged by road test as well as wheel pull).

3. Data Handling: Manual.

4. Check-Out: After the inspection, the supervisor counsels the customer on items that should be repaired. This counseling takes 5-15 minutes, depending on the patron's understanding and additional questions. Figure 2 is the inspection check-off list used.

IV. FEES

1. Diagnostic Inspection: $25.00 for automobiles (members only)
   $30.00 for trucks (members only)

2. Other Services: Reinspection - charged according to mechanic's hourly rate. No repairs performed.

V. TEST EQUIPMENT

1. Brakes: A road test and a wheel pull are used to check brakes.

2. Alignment: Road test and visual check of tire wear pattern.

3. Headlight Aim: Marquette Optical Headlight Aimer.

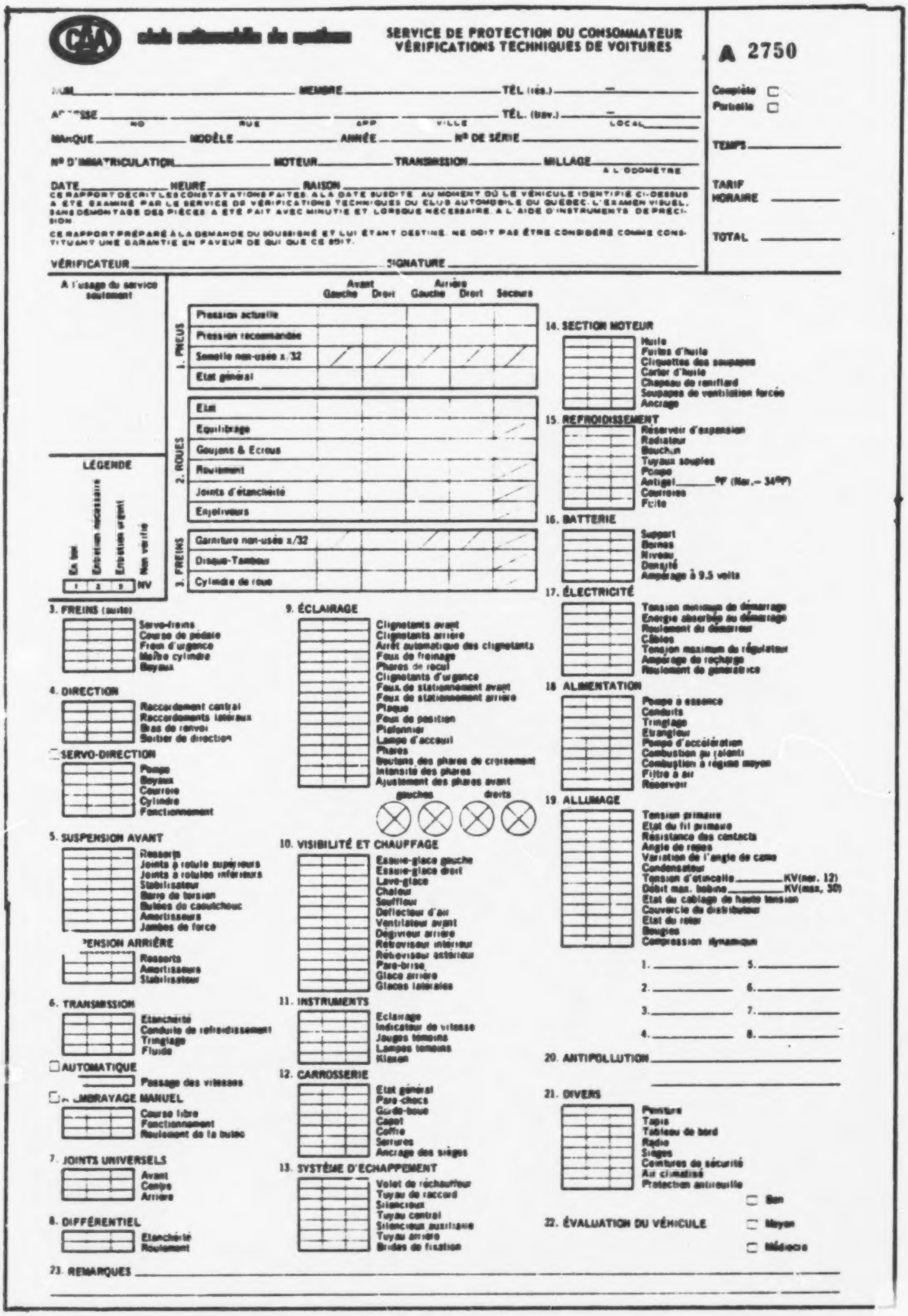
4. Lift: (Two) hydraulic jacks.

5. Emission Analyzer: (Two) Marquette #42-159.

6. Engine Analyzer: (Two) Marquette Electronic Engine Analyzer and Scope 40-275.

7. Dynamometer: A Bear "Autorol" equipped with two eight-inch rollers.

8. Noise Testing: Radio Shack Realistic Sound Level Meter (Approximately $60.oo). Used if the car has a noise problem.



club automobile du québec

SERVICE DE PROTECTION DU CONSOMMATEUR
VÉRIFICATIONS TECHNIQUES DE VOITURES

A 2750

Complète ☐
Partielle ☐

TEMPS ______

TARIF HORAIRE ______

TOTAL ______

NOM ______ MEMBRE ______ TÉL (rés.) ______ – ______
ADRESSE ______ NO ______ RUE ______ APP ______ VILLE ______ TÉL. (trav.) ______ – ______ LOCAL ______
MARQUE ______ MODÈLE ______ ANNÉE ______ Nº DE SÉRIE ______
Nº D'IMMATRICULATION ______ MOTEUR ______ TRANSMISSION ______ MILLAGE ______ À L'ODOMÈTRE
DATE ______ HEURE ______ RAISON ______

CE RAPPORT DÉCRIT LES CONSTATATIONS FAITES, À LA DATE SUSDITE, AU MOMENT OÙ LE VÉHICULE IDENTIFIÉ CI-DESSUS A ÉTÉ EXAMINÉ PAR LE SERVICE DE VÉRIFICATIONS TECHNIQUES DU CLUB AUTOMOBILE DU QUÉBEC. L'EXAMEN VISUEL, SANS DÉMONTAGE DES PIÈCES A ÉTÉ FAIT AVEC MINUTIE ET LORSQUE NÉCESSAIRE, À L'AIDE D'INSTRUMENTS DE PRÉCISION.

CE RAPPORT PRÉPARÉ À LA DEMANDE DU SOUSSIGNÉ ET LUI ÉTANT DESTINÉ, NE DOIT PAS ÊTRE CONSIDÉRÉ COMME CONSTITUANT UNE GARANTIE EN FAVEUR DE QUI QUE CE SOIT.

VÉRIFICATEUR ______ SIGNATURE ______

A l'usage du service seulement

LÉGENDE

En bon	Entretien nécessaire	Entretien urgent	Non vérifié
1	2	3	NV

		Avant Gauche	Avant Droit	Arrière Gauche	Arrière Droit	Secours
1. PNEUS	Pression actuelle					
	Pression recommandée					
	Semelle non-usée x/32	/	/	/	/	/
	Etat général					
2. ROUES	Etat					
	Equilibrage					/
	Goujons & Ecrous					
	Roulement					/
	Joints d'étanchéité					/
	Enjoliveurs					/
3. FREINS	Garniture non-usée x/32	/		/	/	/
	Disque-Tambour					/
	Cylindre de roue					/

3. FREINS (suite)
- Servo-freins
- Course de pédale
- Frein d'urgence
- Maître cylindre
- Boyaux

4. DIRECTION
- Raccordement central
- Raccordements latéraux
- Bras de renvoi
- Boîtier de direction

☐ **SERVO-DIRECTION**
- Pompe
- Boyaux
- Courroie
- Cylindre
- Fonctionnement

5. SUSPENSION AVANT
- Ressorts
- Joints à rotule supérieurs
- Joints à rotules inférieurs
- Stabilisateur
- Barre de torsion
- Butées de caoutchouc
- Amortisseurs
- Jambes de force

ENSION ARRIÈRE
- Ressorts
- Amortisseurs
- Stabilisateur

6. TRANSMISSION
- Etanchéité
- Conduite de refroidissement
- Tringlage
- Fluide

☐ **AUTOMATIQUE**
- Passage des vitesses

☐ **MBRAYAGE MANUEL**
- Course libre
- Fonctionnement
- Roulement de la butée

7. JOINTS UNIVERSELS
- Avant
- Centre
- Arrière

8. DIFFÉRENTIEL
- Etanchéité
- Roulement

9. ÉCLAIRAGE
- Clignotants avant
- Clignotants arrière
- Arrêt automatique des clignotants
- Feux de freinage
- Phares de recul
- Clignotants d'urgence
- Feux de stationnement avant
- Feux de stationnement arrière
- Plaque
- Feux de position
- Plafonnier
- Lampe d'accueil
- Phares
- Boutons des phares de croisement
- Intensité des phares
- Ajustement des phares avant

gauches ⊗ ⊗ droits ⊗ ⊗

10. VISIBILITÉ ET CHAUFFAGE
- Essuie-glace gauche
- Essuie-glace droit
- Lave-glace
- Chaleur
- Souffleur
- Deflecteur d'air
- Ventilateur avant
- Dégivreur arrière
- Rétroviseur intérieur
- Rétroviseur extérieur
- Pare-brise
- Glace arrière
- Glaces latérales

11. INSTRUMENTS
- Eclairage
- Indicateur de vitesse
- Jauges témoins
- Lampes témoins
- Klaxon

12. CARROSSERIE
- Etat général
- Pare-chocs
- Garde-boue
- Capot
- Coffre
- Serrures
- Ancrage des sièges

13. SYSTÈME D'ECHAPPEMENT
- Volet de réchauffeur
- Tuyau de raccord
- Silencieux
- Tuyau central
- Silencieux auxiliaire
- Tuyau arrière
- Brides de fixation

14. SECTION MOTEUR
- Huile
- Fuites d'huile
- Cliquettes des soupapes
- Carter d'huile
- Chapeau de reniflard
- Soupapes de ventilation forcée
- Ancrage

15. REFROIDISSEMENT
- Réservoir d'expansion
- Radiateur
- Bouchon
- Tuyaux souples
- Pompe
- Antigel ______ °F (Nor.– 34°F)
- Courroies
- Fuite

16. BATTERIE
- Support
- Bornes
- Niveau
- Densité
- Ampérage à 9.5 volts

17. ÉLECTRICITÉ
- Tension minimum de démarrage
- Energie absorbée au démarrage
- Roulement du démarreur
- Câbles
- Tension maximum du régulateur
- Ampérage de recharge
- Roulement de génératrice

18 ALIMENTATION
- Pompe à essence
- Conduits
- Tringlage
- Etrangleur
- Pompe d'accélération
- Combustion au ralenti
- Combustion à régime moyen
- Filtre à air
- Réservoir

19. ALLUMAGE
- Tension primaire
- Etat du fil primaire
- Résistance des contacts
- Angle de repos
- Variation de l'angle de came
- Condensateur
- Tension d'étincelle ______ KV(nor. 12)
- Débit max. bobine ______ KV(max. 30)
- Etat du câblage de haute tension
- Couvercle du distributeur
- Etat du rotor
- Bougies
- Compression dynamique

1. ______ 5. ______
2. ______ 6. ______
3. ______ 7. ______
4. ______ 8. ______

20. ANTIPOLLUTION ______

21. DIVERS
- Peinture
- Tapis
- Tableau de bord
- Radio
- Sièges
- Ceintures de sécurité
- Air climatisé
- Protection antirouille

22. ÉVALUATION DU VÉHICULE
☐ Bon
☐ Moyen
☐ Médiocre

23. REMARQUES ______

FIGURE 2. INSPECTION CHECK-OFF LIST

BEST DOCUMENT AVAILABLE

9. Fuel Economy Testing: Not a separate item, but is evaluated indirectly as part of emissions test.

10. Other Equipment: Marquette Battery Starter Tester, manual power tools.

11. Back-Up: The center does not maintain back-up equipment.

12. Plans for Replacement: Not for the next year. Because of the increased work load the center will first go on a night shift. Within two years the center may increase its facility size and install more equipment. This is in the very preliminary planning stage. No additional dynamometer usage is planned.

13. Technical Library: Utilize Chilton publication and shop manuals of manufacturers for reference.

14. Mobile Equipment: The center no longer uses mobile equipment.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Maintenance: Equipment is checked by the Instrument Sales and Service Company. They maintain the equipment every month in the Summer (busy season) and every two months in the Winter.

2. Frequency of Emission Analyzer Gas Calibration: The analyzer is calibrated by Marquette twice per year. The instrument settings are checked by the mechanic after every use (internal electrical zero and span check only).

VII. FACILITY STAFFING

1. Program Director: (One) McFadden.

2. Station Manager: (One) Gilbert Gagnon (supervisor on floor).

3. Master Mechanics:* Two.

4. Junior Mechanics: None.

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* All inspections are performed by the master mechanics.

5. Diagnosticians: None.

6. Aides: None.

7. Clerical: None.

8. Other: None.

VIII. TRAINING

1. Inspector Experience Requirements: Mechanics are required to be second-class mechanics with training. Supervisors must be first-class mechanics with experience. All Club mechanics are licensed and certified by the Quebec Parity Committee.

2. Employee Training Provisions: No structured provisions.

3. Technical Update Meetings: Approximately every six months the staff members meet with representatives of the auto manufacturing companies.

IX. QUALITY CONTROL

1. Supervision for Instructors: Daily supervision.

2. Surveys or Studies of Customer Satisfaction: None.

3. Criteria for Vehicle Failure: In most cases mechanic judgment is used to determine failure. In cases where quantitative standards are required, i.e., balljoints, the manufacturer's specifications are used.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

If a customer returns and wants just one item checked to see that the repair was done correctly, there is no charge. A complete reinspection will be charged according to the amount of time required to reinspect the vehicle.

XI. CUSTOMER INTERFACE

1. Counseling: The supervisor counsels the customer and provides a prescription for the types of repairs that are needed. He will estimate the approximate cost of repairs if asked. He does not recommend any particular repair

facility. If pressed, he will suggest use of a facility that is recommended by the Canadian Automobile Association.

2. Additional Customer Services: None.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time Per Vehicle: Automobile - Approx. one hour Truck - 1½ hours.

2. Time at Each Station in the Lane: Although no lanes are used, the estimated times for inspection are:

   - Removal of two wheels to inspect brakes (15-20 minutes)
   - Suspension check (10 minutes)
   - Road test (5 minutes) or road simulation (2 minutes)
   - Engine and emissions tests (15 minutes)
   - Visual inspection (5 minutes).
   - Counseling (5-10)

3. Theoretical Maximum Lane Throughput: 15 per day.

4. Average Bay Throughput: The average is approximately 8 vehicles per bay per hour for two bays, or approximately 12 to 13 vehicles per day.

5. Appointments Used: Yes.

6. Busiest Time of Year: April-September. Winter months are slow.

7. Maximum Number of Vehicles Processed per Hour for the Entire Facility: Two.

XIII. CONSUMER AND COMMUNITY RELATIONS

The center is a component of the Canadian Automobile Association (CAA). The CAA maintains a consumer protection service for its members.

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment: Initial equipment cost (1978) was $25,000. Modifications to the existing facilities to incorporate an air compressor and associated air lines cost approximately $1,000.

2. Current Average Hourly Labor Rate: Approximately $7/hour for the mechanics.

3. Building and Land Costs: Building and land leased as scheduled below ($3,900 per year).

4. Operating Costs (1980):

Operating Expenses	Per Day	Per Year
Rent	$ 15.60	$ 3,900.00
Heat & Electricity	4.48	1,120.00
Depreciation	12.00	4,800.00
Equipment Repairs	3.20	800.00
Taxes (Water, Montreal)	5.72	1,430.28
V.I.C. Publicity	4.00	1,000.00
Salaries (three men)	152.00	38,000.00
Miscellaneous	5.20	1,300.00
TOTAL	$202.20	$52,350.00
Breakeven inspections needed	8.08	2,094.00

During 1980 the Club slightly exceeded its goal to break even on costs.

[redacted]

AUTO CLUB CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: Quebec Auto Club Diagnostic Center
2600, Boulevard Laurier
C.P. 9600
Sainte-Foy G1V 4K8

2. Contact Name and Number: Richard Belanger
(418) 653-2600

3. General Description of the Facility: This two-lane facility opened in January,1980. Formerly the center was housed in a small service station. This auto club performs limited repairs as well as inspections.

4. Vehicle Types Inspected: Passenger cars, light trucks, diesels.

5. Types of Inspection Services: The diagnostic inspection includes a brake dynamometer test, a wheel alignment test using a scuff gauge, a headlamp aim inspection, and an engine and emissions analysis. A visual inspection of other subsystems (steering, suspension, wheels, tires, etc.) complements the instrumented diagnostic inspections. Reinspection services are provided for a fee.

6. Operating Hours: M-F, 8:00 a.m. to 5:30 p.m.

7. Physical Area of Inspection Facility: The facility, which includes two inspection lanes, a reception/waiting room, offices, repair space, and a small store for club members, is housed in an area of approximately 4,777square feet (diagram not available).

8. Inspection Station Dimensions: 65' x 73.5'.

9. Number of Lanes/Bays: Two lanes which converge on an Autosense engine analyzer and a dynamometer.

10. Lane Dimensions: 65' x 28'.

11. Queueing Area: The vehicles to be inspected wait in the parking lot.

12. Parking Area: The parking lot will accommodate 35-40 cars.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Built: Built in 1979. Opened in January, 1980.

2. Construction Type and Material: Cement block.

3. Patron Accommodations in Addition to Lanes: The facility provides a room where customers may view the inspection process.

4. Ventilation System Design: The ventilation system is comprised of an exhaust fan with inlet tubes imbedded in the floor at the stations where vehicles must be operating as part of the inspection.

5. Safety Accommodations
Standard building code requirements are met.

6. Noise Accommodations Glass windows separating the lanes from the customer waiting area.

III. STEPS OF INSPECTION PROCESS

1. Check-In: The patron completes personal information (name, address, telephone number) on form which is given back to him in the counseling session (see Figure 1).

2. Test Sequence: Approximately 100 items are inspected in the following sequence:*

   - Vehicle is placed on hoist and visual inspection is made of brakes (two wheels pulled), suspension, steering linkages, transmission, exhaust components, wheels and tires
   - Headlight aim
   - Engine and emissions analysis on Autosense unit

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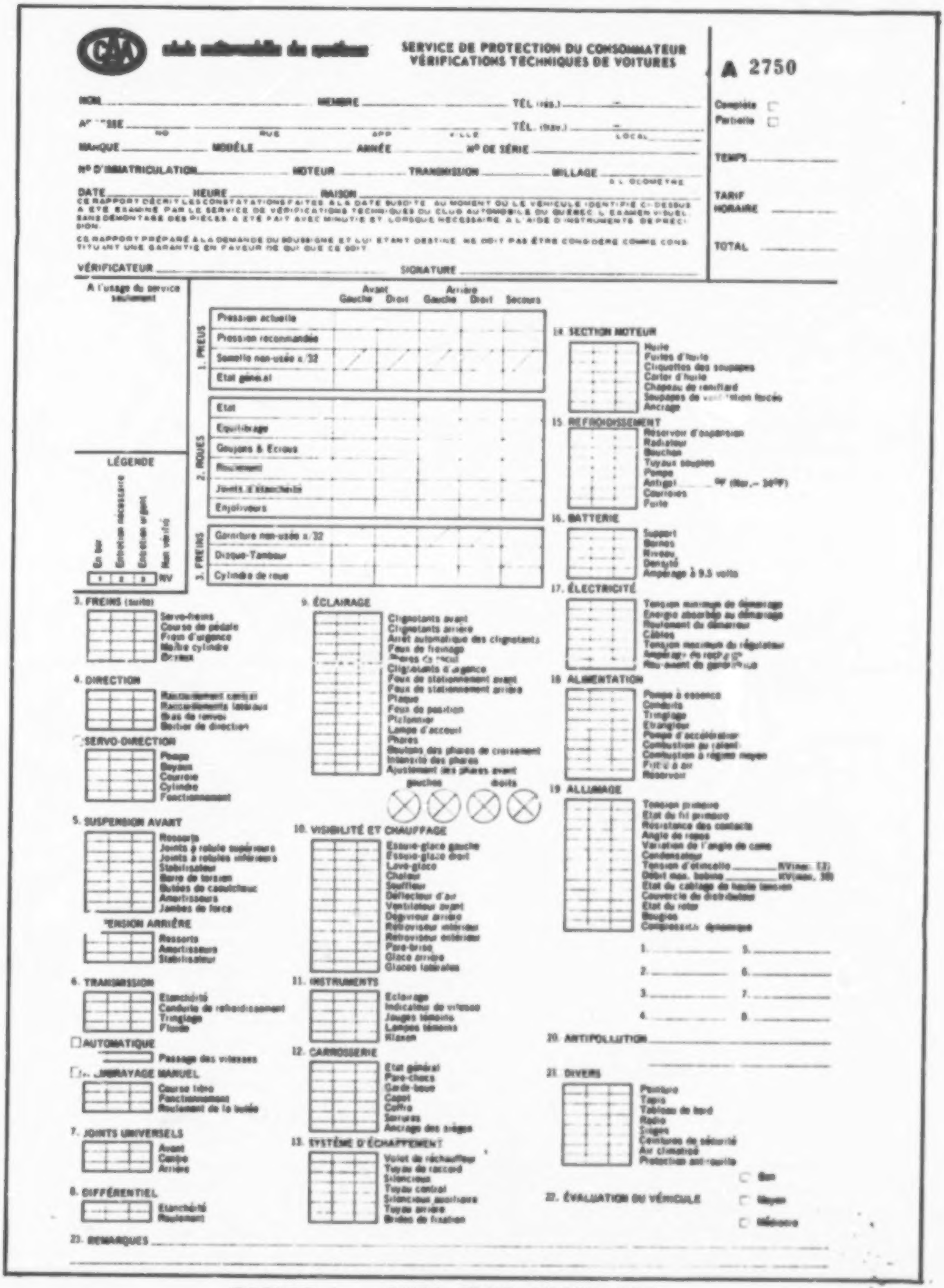
* Vehicle parameters are evaluated against the recommended manufacturer's specifications.



CAA club automobile du québec

SERVICE DE PROTECTION DU CONSOMMATEUR
VÉRIFICATIONS TECHNIQUES DE VOITURES

A 2750

Complète ☐
Partielle ☐

NOM ______ MEMBRE ______ TÉL. (rés.) ______
ADRESSE ______ NO ______ RUE ______ APP ______ VILLE ______ TÉL. (trav.) ______ LOCAL ______
MARQUE ______ MODÈLE ______ ANNÉE ______ Nº DE SÉRIE ______
Nº D'IMMATRICULATION ______ MOTEUR ______ TRANSMISSION ______ MILLAGE ______ À L'ODOMÈTRE
DATE ______ HEURE ______ RAISON ______

TEMPS ______
TARIF HORAIRE ______
TOTAL ______

CE RAPPORT DÉCRIT LES CONSTATATIONS FAITES À LA DATE SUSDITE AU MOMENT OÙ LE VÉHICULE IDENTIFIÉ CI-DESSUS A ÉTÉ EXAMINÉ PAR LE SERVICE DE VÉRIFICATIONS TECHNIQUES DU CLUB AUTOMOBILE DU QUÉBEC. L'EXAMEN VISUEL SANS DÉMONTAGE DES PIÈCES A ÉTÉ FAIT AVEC MINUTIE ET LORSQUE NÉCESSAIRE À L'AIDE D'INSTRUMENTS DE PRÉCISION.

CE RAPPORT PRÉPARÉ À LA DEMANDE DU SOUSSIGNÉ ET LUI ÉTANT DESTINÉ NE DOIT PAS ÊTRE CONSIDÉRÉ COMME CONSTITUANT UNE GARANTIE EN FAVEUR DE QUI QUE CE SOIT.

VÉRIFICATEUR ______ SIGNATURE ______

À l'usage du service seulement

LÉGENDE

En bon	Entretien nécessaire	Entretien urgent	Non vérifié
1	2	3	NV

		Avant Gauche	Avant Droit	Arrière Gauche	Arrière Droit	Secours
1. PNEUS	Pression actuelle					
	Pression recommandée					
	Semelle non-usée x/32					
	État général					
2. ROUES	État					
	Équilibrage					
	Goujons & Écrous					
	Roulement					
	Joints d'étanchéité					
	Enjoliveurs					
3. FREINS	Garniture non-usée x/32					
	Disque-Tambour					
	Cylindre de roue					

3. FREINS (suite)
- Servo-freins
- Course de pédale
- Frein d'urgence
- Maître cylindre
- Boyaux

4. DIRECTION
- Raccordement central
- Raccordements latéraux
- Bras de renvoi
- Boîtier de direction

☐ **SERVO-DIRECTION**
- Pompe
- Boyaux
- Courroie
- Cylindre
- Fonctionnement

5. SUSPENSION AVANT
- Ressorts
- Joints à rotule supérieurs
- Joints à rotules inférieurs
- Stabilisateur
- Barre de torsion
- Butées de caoutchouc
- Amortisseurs
- Jambes de force

SUSPENSION ARRIÈRE
- Ressorts
- Amortisseurs
- Stabilisateur

6. TRANSMISSION
- Étanchéité
- Conduite de refroidissement
- Tringlage
- Fluide

☐ **AUTOMATIQUE**
- Passage des vitesses

☐ **EMBRAYAGE MANUEL**
- Course libre
- Fonctionnement
- Roulement de la butée

7. JOINTS UNIVERSELS
- Avant
- Centre
- Arrière

8. DIFFÉRENTIEL
- Étanchéité
- Roulement

9. ÉCLAIRAGE
- Clignotants avant
- Clignotants arrière
- Arrêt automatique des clignotants
- Feux de freinage
- Phares de recul
- Clignotants d'urgence
- Feux de stationnement avant
- Feux de stationnement arrière
- Plaque
- Feux de position
- Plafonnier
- Lampe d'accueil
- Phares
- Boutons des phares de croisement
- Intensité des phares
- Ajustement des phares avant

gauche droits

10. VISIBILITÉ ET CHAUFFAGE
- Essuie-glace gauche
- Essuie-glace droit
- Lave-glace
- Chaleur
- Souffleur
- Déflecteur d'air
- Ventilateur avant
- Dégivreur arrière
- Rétroviseur intérieur
- Rétroviseur extérieur
- Pare-brise
- Glace arrière
- Glaces latérales

11. INSTRUMENTS
- Éclairage
- Indicateur de vitesse
- Jauges témoins
- Lampes témoins
- Klaxon

12. CARROSSERIE
- État général
- Pare-chocs
- Garde-boue
- Capot
- Coffre
- Serrures
- Ancrage des sièges

13. SYSTÈME D'ÉCHAPPEMENT
- Volet de réchauffeur
- Tuyau de raccord
- Silencieux
- Tuyau central
- Silencieux auxiliaire
- Tuyau arrière
- Brides de fixation

14. SECTION MOTEUR
- Huile
- Fuites d'huile
- Cliquettes des soupapes
- Carter d'huile
- Chapeau de reniflard
- Soupapes de ventilation forcée
- Ancrage

15. REFROIDISSEMENT
- Réservoir d'expansion
- Radiateur
- Bouchon
- Tuyaux souples
- Pompe
- Antigel ______ °F (Rec. – 30°F)
- Courroies
- Fuite

16. BATTERIE
- Support
- Bornes
- Niveau
- Densité
- Ampérage à 9.5 volts

17. ÉLECTRICITÉ
- Tension minimum de démarrage
- Énergie absorbée au démarrage
- Roulement du démarreur
- Câbles
- Tension maximum du régulateur
- Ampérage de recharge
- Roulement de génératrice

18. ALIMENTATION
- Pompe à essence
- Conduits
- Tringlage
- Étrangleur
- Pompe d'accélérateur
- Combustion au ralenti
- Combustion à régime moyen
- Filtre à air
- Réservoir

19. ALLUMAGE
- Tension primaire
- État du fil primaire
- Résistance des contacts
- Angle de repos
- Variation de l'angle de came
- Condensateur
- Tension d'étincelle ______ KV(min. 13)
- Débit max. bobine ______ KV(min. 30)
- État du câblage de haute tension
- Couvercle de distributeur
- État du rotor
- Bougies
- Compression dynamique

1. ______ 5. ______
2. ______ 6. ______
3. ______ 7. ______
4. ______ 8. ______

20. ANTIPOLLUTION ______

21. DIVERS
- Peinture
- Tapis
- Tableau de bord
- Radio
- Sièges
- Ceintures de sécurité
- Air climatisé
- Protection anti-rouille

22. ÉVALUATION DU VÉHICULE
☐ Bon
☐ Moyen
☐ Médiocre

23. REMARQUES ______

FIGURE 1. AUTO CLUB CHECKLIST

BEST DOCUMENT AVAILABLE

- Wheel alignment by scuff gauge test
- Brake test utilizing dynamometer.

3. Data Handling: Both manual and automated forms document the inspection results: a manual form is filled out by the inspector on the visual inspection items and on the inspection elements that do not have an automated printout. A computerized printout is provided by the Autosense engine and emissions analyzer (see Figure 2).

4. Check-Out: The forms indicating the findings and the actions required are given to the patron in a consulting session. The consulting session reviewing the significance of the findings lasts approximately 10 minutes.

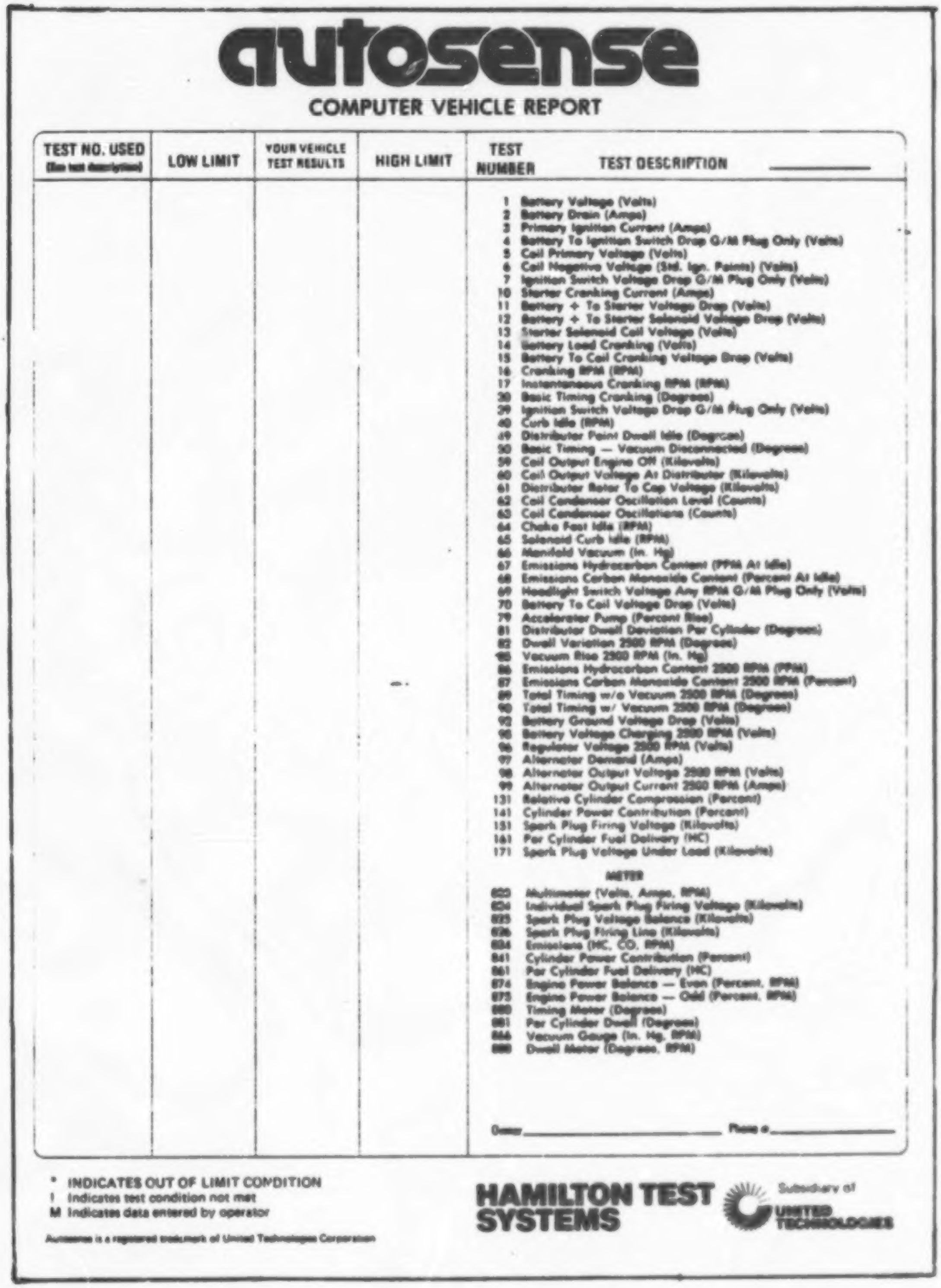
IV. FEES (1980)

1. Diagnostic Inspection: $35.00 for members
   $40.00 for nonmembers

2. Other Services: Repairs of brakes and tire repairs are accommodated at an hourly rate of $24 per hour.

V. TEST EQUIPMENT

1. Brakes: Clayton Brake Analyzer - Dynamometer DB8-200.
2. Alignment: Bear Scuff Gauge.
3. Headlight Aim: Sun Headlight Aimer.
4. Lift: (4) Smith Hoists #DT 10 AF (2 for inspection and 2 for repair).
5. Emission Analyzer: Hamilton Test Systems Autosense System.
6. Engine Analyzer: Part of Autosense.
7. Dynamometer: Clayton (see Brakes). No chassis dynamometer.
8. Noise: Sun noise meter (used to give road tests for new cars).



autosense

COMPUTER VEHICLE REPORT

TEST NO. USED (See test description)	LOW LIMIT	YOUR VEHICLE TEST RESULTS	HIGH LIMIT	TEST NUMBER	TEST DESCRIPTION ______________

1 Battery Voltage (Volts)
2 Battery Drain (Amps)
3 Primary Ignition Current (Amps)
4 Battery To Ignition Switch Drop G/M Plug Only (Volts)
5 Coil Primary Voltage (Volts)
6 Coil Negative Voltage (Std. Ign. Points) (Volts)
7 Ignition Switch Voltage Drop G/M Plug Only (Volts)
10 Starter Cranking Current (Amps)
11 Battery + To Starter Voltage Drop (Volts)
12 Battery + To Starter Solenoid Voltage Drop (Volts)
13 Starter Solenoid Coil Voltage (Volts)
14 Battery Load Cranking (Volts)
15 Battery To Coil Cranking Voltage Drop (Volts)
16 Cranking RPM (RPM)
17 Instantaneous Cranking RPM (RPM)
30 Basic Timing Cranking (Degrees)
39 Ignition Switch Voltage Drop G/M Plug Only (Volts)
40 Curb Idle (RPM)
49 Distributor Point Dwell Idle (Degrees)
50 Basic Timing — Vacuum Disconnected (Degrees)
59 Coil Output Engine Off (Kilovolts)
60 Coil Output Voltage At Distributor (Kilovolts)
61 Distributor Rotor To Cap Voltage (Kilovolts)
62 Coil Condenser Oscillation Level (Counts)
63 Coil Condenser Oscillations (Counts)
64 Choke Fast Idle (RPM)
65 Solenoid Curb Idle (RPM)
66 Manifold Vacuum (In. Hg)
67 Emissions Hydrocarbon Content (PPM At Idle)
68 Emissions Carbon Monoxide Content (Percent At Idle)
69 Headlight Switch Voltage Any RPM G/M Plug Only (Volts)
70 Battery To Coil Voltage Drop (Volts)
79 Accelerator Pump (Percent Rise)
81 Distributor Dwell Deviation Per Cylinder (Degrees)
82 Dwell Variation 2500 RPM (Degrees)
85 Vacuum Rise 2500 RPM (In. Hg)
86 Emissions Hydrocarbon Content 2500 RPM (PPM)
87 Emissions Carbon Monoxide Content 2500 RPM (Percent)
89 Total Timing w/o Vacuum 2500 RPM (Degrees)
90 Total Timing w/ Vacuum 2500 RPM (Degrees)
92 Battery Ground Voltage Drop (Volts)
95 Battery Voltage Charging 2500 RPM (Volts)
96 Regulator Voltage 2500 RPM (Volts)
97 Alternator Demand (Amps)
98 Alternator Output Voltage 2500 RPM (Volts)
99 Alternator Output Current 2500 RPM (Amps)
131 Relative Cylinder Compression (Percent)
141 Cylinder Power Contribution (Percent)
151 Spark Plug Firing Voltage (Kilovolts)
161 Per Cylinder Fuel Delivery (HC)
171 Spark Plug Voltage Under Load (Kilovolts)

METER

820 Multimeter (Volts, Amps, RPM)
824 Individual Spark Plug Firing Voltage (Kilovolts)
825 Spark Plug Voltage Balance (Kilovolts)
826 Spark Plug Firing Line (Kilovolts)
834 Emissions (HC, CO, RPM)
841 Cylinder Power Contribution (Percent)
861 Per Cylinder Fuel Delivery (HC)
874 Engine Power Balance — Even (Percent, RPM)
875 Engine Power Balance — Odd (Percent, RPM)
880 Timing Meter (Degrees)
881 Per Cylinder Dwell (Degrees)
866 Vacuum Gauge (In. Hg, RPM)
890 Dwell Meter (Degrees, RPM)

Owner ______________________ Phone # ______________________

* INDICATES OUT OF LIMIT CONDITION
! Indicates test condition not met
M Indicates data entered by operator

Autosense is a registered trademark of United Technologies Corporation

HAMILTON TEST SYSTEMS

Subsidiary of UNITED TECHNOLOGIES

FIGURE 2. AUTOSENSE CHECKLIST

BEST DOCUMENT AVAILABLE

9. Fuel Economy: No equipment. Fuel lines are visually inspected.

10. Plans for Replacement: None. Equipment is all fairly new.

11. Back-Up Provisions: The facility does not maintain back-up equipment.

12. Technical Library: A collection of the Mitchell publications and shop manuals of the major auto manufacturers are available for ready reference.

13. Mobile Equipment: The facility does not operate mobile equipment.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: Dynamometer is checked once a week. The Autosense is maintained once a month.

2. Frequency of Gas Calibration for Emission Analyzer: Autosense is self-calibrating.

VII. FACILITY STAFFING

1. Program Director: Richard Belanger, Director of Technical Center.
2. Station Manager: One.
3. Master Mechanics:* Three.
4. Junior Mechanics:* Two.
5. Diagnostician: One counselor.
6. Aides: None.
7. Clerical: None.
8. Other: None.

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* Inspections are performed by the junior and master mechanics.

VIII. TRAINING

1. Inspector Experience Requirements: All mechanics hired must have a Canadian mechanic's license and five years experience as a bench mechanic.

2. Employee Training Provisions: Training provided by auto manufacturer's representatives.

3. Technical Update Meetings: Staff meetings are held once a month and are used as a platform for technical subject review.

IX. QUALITY CONTROL

1. Supervision for Inspectors: The station manager handles day-to-day problems. Any difficult problems are forwarded to the Center Director (Belanger).

2. Surveys of Customer Satisfaction: Questionnaires are occasionally distributed. No results available.

3. Criteria for Failure: Manufacturer's specifications are available in automotive technical manuals and spec books and are used by the staff members.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Reinspections are charged according to an hourly rate of ($24.00).

XI. CUSTOMER INTERFACE

1. Counseling: A counselor reviews the test results with the customer. The checked item list is given to him/her as a document to show the repair facility. He/she is provided with names of garages that are on the Canadian Automobile Association (CAA) list. If the customer asks, he is given a "ballpark figure" on anticipated repair cost.

2. Additional Customer Services: Complete brake repair services and tire replacement are provided for a fee. A school for auto repair will be started in the near future.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: 85 minutes.
2. Time at Each Station in the Lane:
   - Hoist - 45 minutes
   - Autosense - 20 minutes
   - Dynamometer - 20 minutes.
3. Theoretical Maximum Lane Throughput: Seven vehicles per day.
4. Average Lane Throughput: Six vehicles per day.
5. Appointments Used: Yes.
6. Busiest Time of Year: April-June.
7. Maximum Number of Vehicles Processed for the Entire Facility: Goal is 14 per day. Currently the facility is experiencing 12 cars per day throughput, or 1¼ cars per hour.

XIII. CONSUMER AND COMMUNITY RELATIONS

The diagnostic center is a component of the CAA. The parent organization maintains a consumer protection service for its members (more than 100,000) and contracts with professional and community associations. Neither the diagnostic center nor its staff are presently involved in any community-related project.

XIV. INVESTMENT AND OPERATING COSTS

1. Inital Facility Investment:

Structure and Grounds	-	$208,000 (Canadian Dollars)
Equipment	-	70,000
Other start-up costs	-	67,000.

2. Current Average Hourly Labor Rate:

   - Rate earned by Class A mechanics (all inspectors) - $9/hour
   - Rate charged to customers - $24/hour.

3. Operating Costs: The Center has provided this itemized list of present operating costs:

. Salaries*	$123,933	(Canadian Dollars)
. Fringe benefits	10,200	
. Telephone	1,335	
. Printing	1,200	
. Office expenses	700	
. Bank credit and charges	1,700	
. Equipment and truck maintenance	1,000	
. Amortizing of equipment and truck	6,352	
. Membership discounts	8,000	
. Upkeep of uniforms	1,000	
. Accident insurance	4,200	
. Interest on loan	11,000	
. Miscellaneous	73,600	
Total	$244,220	

During the first year of operation the Club lost approximately $65,000.

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* Includes all personnel.

AUTO CLUB CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. **Facility Name and Address:** California State Automobile Association
San Jose Diagnostic Clinic
San Jose, California

2. **Contact Name and Number:** Don Consgrove, Manager Automotive Technical Services
(415)565-2026

Ed Brown, Station Manager
(408)247-5405

3. **General Description of Facility:** The San Jose Diagnostic Clinic is a concrete one-story building with four long bays (70 feet long). One bay is used solely to drive the vehicles to the rear of the facility. Over 100 tests are conducted including a dynamic brake test, dynamic alignment test and loaded mode engine testing.

4. **Vehicle Types Inspected:** Passenger cars, trucks up to 1/2 ton, vans less than 74" high (height limitation at entrance), no motorcycles.

5. **Type of Inspection Services:** Full diagnostic inspection or partial test. No repairs.

6. **Operating Hours:** 7:30 a.m. to 5:00 p.m. (M-F). Diagnostic appointments are made from 8:00 a.m. to 4:00 p.m.

7. **Physical Area of Inspection Facility:** The floor space of the diagnostic inspection area is 4,900 square feet. The total facility area is 7,040 square feet.

8. **Inspection Station Dimensions:** 70' x 70'

9. **Number of Lanes/Bays:** Four long bays. The building layout uses a more square land area than a lane operation and offers some flexibility for exit during the middle of the test procedure.

10. **Queueing Area:** Not needed since appointments are used.

11. **Parking Area:** Can accomodate approximately 25 vehicles.

12. Facility Diagram and Location of Equipment: See Figure 1. A shallow pit is located beneath the rack for underbody inspections.

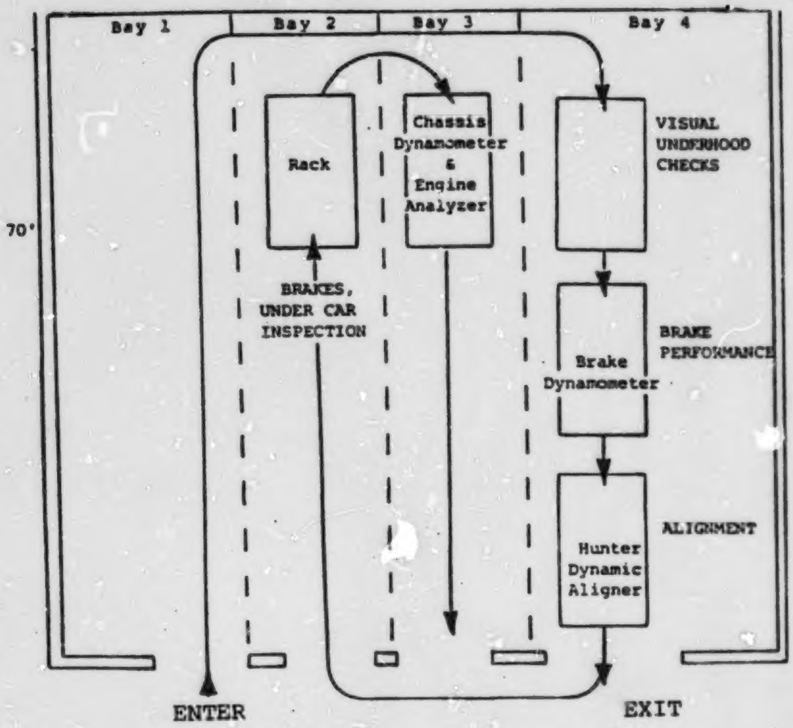
Bay 1
Bay 2
Bay 3
Bay 4
Rack
Chassis Dynamometer & Engine Analyzer
VISUAL UNDERHOOD CHECKS
70'
BRAKES, UNDER CAR INSPECTION
BRAKE PERFORMANCE
Brake Dynamometer
ALIGNMENT
Hunter Dynamic Aligner
ENTER
EXIT

FIGURE 1. LAYOUT OF SAN JOSE FACILITY

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Built: 1974

2. Construction Type and Materials: Concrete block walls, concrete floor.

3. Patron Accommodations in Addition to Lanes: A viewing area is provided for customers. Patrons are not permitted in the lanes.

4. Ventilation System Design: Clayton exhaust louvres (Clayton 4-DES-2) and an exhaust fan system with blowers. The shallow pit used for underchassis inspections is ventilated.

[redacted]

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5. Safety Accommodations: Safety glass is provided for the patron viewing area.

6. Noise Accommodations: A plywood box is placed next to the dynamometer to absorb some of the noise generated by the dynamometer. Acoustical tiles line the walls and ceiling. The dynamometer is equipped with sound deadening rolls.

III. STEPS OF INSPECTION PROCESS

1. Data Handling: All data handling is manual. The vehicle parameters are noted on the diagnostic checksheet shown in Figure 2. Recommended repair actions are noted on the checksheet.

2. Inspection Sequence:

   - Station 1, Underhood check of engine, fluid levels, hoses, tire pressure
   - Station 2, Dynamic brake test on dynamometer
   - Station 3, Alignment test
   - Station 4, Vehicle on lift, check under body
   - Station 5, Vehicle on chassis dynamometer, engine checked with oscilloscope.

A detailed explanation of the test procedures at each station is given in Table 1.

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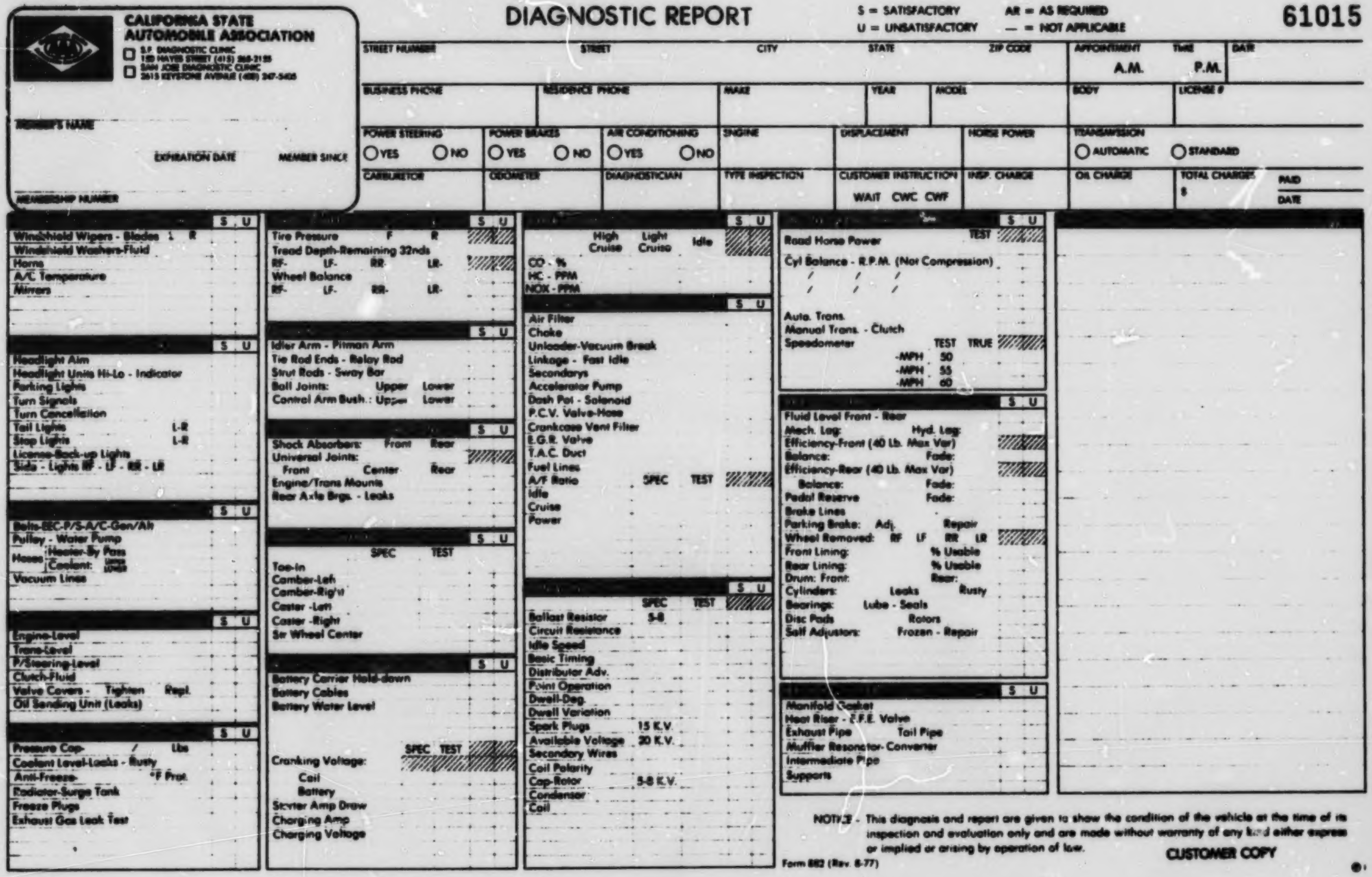
BEST DOCUMENT AVAILABLE

FIGURE 2. DIAGNOSTIC INSPECTION REPORT



CALIFORNIA STATE AUTOMOBILE ASSOCIATION

☐ S.F. DIAGNOSTIC CLINIC
150 HAYES STREET (415) [illegible]
☐ SAN JOSE DIAGNOSTIC CLINIC
2615 KEYSTONE AVENUE (408) [illegible]

MEMBER'S NAME
EXPIRATION DATE
MEMBER SINCE
MEMBERSHIP NUMBER

DIAGNOSTIC REPORT

S = SATISFACTORY
U = UNSATISFACTORY
AR = AS REQUIRED
— = NOT APPLICABLE

61015

STREET NUMBER	STREET	CITY	STATE	ZIP CODE	APPOINTMENT TIME A.M. P.M.	DATE
BUSINESS PHONE	RESIDENCE PHONE	MAKE	YEAR	MODEL	BODY	LICENSE #
POWER STEERING ○ YES ○ NO	POWER BRAKES ○ YES ○ NO	AIR CONDITIONING ○ YES ○ NO	ENGINE	DISPLACEMENT	HORSE POWER	TRANSMISSION ○ AUTOMATIC ○ STANDARD
CARBURETOR	ODOMETER	DIAGNOSTICIAN	TYPE INSPECTION	CUSTOMER INSTRUCTION WAIT CWC CWF	INSP. CHARGE	OIL CHARGE
TOTAL CHARGES $	PAID	DATE				

S U
Windshield Wipers - Blades L R
Windshield Washers-Fluid
Horns
A/C Temperature
Mirrors

S U
Headlight Aim
Headlight Units Hi-Lo - Indicator
Parking Lights
Turn Signals
Turn Cancellation
Tail Lights L-R
Stop Lights L-R
License-Back-up Lights
Side - Lights RF - LF - RR - LR

S U
Belts-EEC-P/S-A/C-Gen/Alt
Pulley - Water Pump
Hoses: Heater-By Pass
Coolant: UPPER LOWER
Vacuum Lines

S U
Engine-Level
Trans-Level
P/Steering-Level
Clutch-Fluid
Valve Covers - Tighten Repl.
Oil Sending Unit (Leaks)

S U
Pressure Cap- / Lbs
Coolant Level-Leaks - Rusty
Anti-Freeze- °F Prot.
Radiator-Surge Tank
Freeze Plugs
Exhaust Gas Leak Test

S U
Tire Pressure F R ▨
Tread Depth-Remaining 32nds
RF- LF- RR- LR- ▨
Wheel Balance
RF- LF- RR- LR-

S U
Idler Arm - Pitman Arm
Tie Rod Ends - Relay Rod
Strut Rods - Sway Bar
Ball Joints: Upper Lower
Control Arm Bush.: Upper Lower

S U
Shock Absorbers: Front Rear
Universal Joints: ▨
Front Center Rear
Engine/Trans Mounts
Rear Axle Brgs. - Leaks

S U
SPEC TEST
Toe-In
Camber-Left
Camber-Right
Caster -Left
Caster -Right
Str Wheel Center

S U
Battery Carrier Hold-down
Battery Cables
Battery Water Level
SPEC TEST ▨
Cranking Voltage: ▨
Coil
Battery
Starter Amp Draw
Charging Amp
Charging Voltage

S U
High Cruise Light Cruise Idle ▨
CO - %
HC - PPM
NOX - PPM

S U
Air Filter
Choke
Unloader-Vacuum Break
Linkage - Fast Idle
Secondarys
Accelerator Pump
Dash Pot - Solenoid
P.C.V. Valve-Hose
Crankcase Vent Filter
E.G.R. Valve
T.A.C. Duct
Fuel Lines
A/F Ratio SPEC TEST ▨
Idle
Cruise
Power

S U
SPEC TEST ▨
Ballast Resistor 5-8
Circuit Resistance
Idle Speed
Basic Timing
Distributor Adv.
Point Operation
Dwell-Deg.
Dwell Variation
Spark Plugs 15 K.V.
Available Voltage 20 K.V.
Secondary Wires
Coil Polarity
Cap-Rotor 5-8 K.V.
Condensor
Coil

S U
TEST ▨
Road Horse Power
Cyl Balance - R.P.M. (Not Compression)
/ / /
/ / /
Auto. Trans.
Manual Trans. - Clutch
Speedometer TEST TRUE ▨
-MPH 50
-MPH 55
-MPH 60

S U
Fluid Level Front - Rear
Mech. Lag: Hyd. Lag:
Efficiency-Front (40 Lb. Max Var) ▨
Balance: Fade:
Efficiency-Rear (40 Lb. Max Var) ▨
Balance: Fade:
Pedal Reserve Fade:
Brake Lines
Parking Brake: Adj. Repair
Wheel Removed: RF LF RR LR ▨
Front Lining: % Usable
Rear Lining: % Usable
Drum: Front: Rear:
Cylinders: Leaks Rusty
Bearings: Lube - Seals
Disc Pads Rotors
Self Adjustors: Frozen - Repair

S U
Manifold Gasket
Heat Riser - E.F.E. Valve
Exhaust Pipe Tail Pipe
Muffler Resonator- Converter
Intermediate Pipe
Supports

NOTICE - This diagnosis and report are given to show the condition of the vehicle at the time of its inspection and evaluation only and are made without warranty of any kind either express or implied or arising by operation of law.

Form 882 (Rev. 8-77)

CUSTOMER COPY

TABLE 1. DETAILED DIAGNOSTIC INSPECTION PROCEDURES AT SAN JOSE AUTO CLUB

STATION #1 SEQUENCE (Time - Approximately 6 Minutes)	
#1*	Pick up car from parking area.
#1	Drive car into Diagnostic Lane, Station #1.
#1	While driving car into Diagnostic Lane, check mirrors, horn operation, windshield washer operation and windshield wiper operation. If car is equipped with air conditioning, turn it to "on" position.
#1	Dismount from car, leave engine running.
#1	Raise hood and place fender covers on each fender.
#2*	Identify engine and write specifications.
#1	With engine running, check level and condition of transmission fluids. Check A/C freon level through sight glass.
#1	Slowly remove radiator cap and note level of cooling system. Put radiator cap on pressure gauge, pump gauge to recommended pressure and lay aside on fender.
#1	With engine still running, take exhaust gas leak test with block check instrument. Take anti-freeze test. Note results.
#1	Check radiator pressure gauge to see if radiator cap is holding recommended pressure. Note results of cap test.
#1	Lock pressure gauge on radiator and pump to 15 pounds pressure. Shut engine off.
#1	Remove air filter and place aside in designated area. Check air filter element on tester. Note results.
#1	Check operation of automatic choke and unloader.
#1	Check operation of dash pot, if so equipped.

---

* #1 - Inspector Number 1
#2 - Inspector Number 2

#1 Check engine oil level.

#1 Check power steering level.

#1 Check brake fluid level.

#1 Check condition of vacuum hoses.

#1 Check radiator and heater hoses for condition and leaks.

#1 Check radiator surge tank and core for leaks. Note results. Remove pressure gauge from radiator.

#1 Check condition and adjustment of all belts.

#1 Check water pump pulley for looseness. Check all pulleys and note results.

#1 Visually inspect engine for oil leaks. Close hood.

#2 Check tire pressure and adjust as necessary.

#1 Check Diagnostic sheet to make sure the results of all previous tests have been entered on the sheet.

STATION #2 SEQUENCE (Time - Approximately 3 minutes)

#1 Drive car forward and position front wheels on Brake Analyzer.

#1 Check the front brakes in the prescribed manner and enter results on Diagnostic Sheet.

#1 Drive car forward to position rear wheels on the brake analyzer. Check rear brakes and enter results.

STATION #3 SEQUENCE (Time - Approximately 4 minutes)

#1 Drive car forward to position front wheels on alignment rollers. Turn on headlights.

#1 Position stabilizer pads and run car through alignment checking sequence. Enter results.

#2 Check headlight aim. Enter results.

STATION #4 SEQUENCE (Time - Approximately 6 minutes)

#1* Pick up car at alignment machine. Check report to see that alignment and headlight aim readings have been entered. Drive car around to rack.

#2* Lift car on hoist to comfortable working level.

#1 Check operation of all lights. Remain in car.

#2 Circle car to verify operation of lights, side markers and license light. Raise rear wheels with air jack to check wheel balance and any unusual bearing or rear end noise.

#1 Run rear wheels at request of Diagnostician. Shut off engine after tests. Remain in car.

#2 Proceed to front of car to mark timing mark with yellow pencil for convenience of Station #5 tests.

#1 Turn ignition key to rotate engine, at request of Diagnostician, to locate timing mark. Dismount from car. Keep report in hand to record any information given by diagnostician.

#2 Return to rear of car to begin inspection. Make all inspections required by report and relay information to #1 man to be recorded. Also record any unusual findings.

#2 Raise front wheels with air jack.

#1 Check raised wheels, in prescribed manner, for looseness or wear in front suspension.

#2 Visually inspect suspension and steering parts on raised wheels.

#1 Spin raised wheels and check for vibration in bumper or wheel.

#1 Remove wheel or wheels designated by brake analyzer for visual inspection of brakes. Check drum with drum gauge.

---

* #1 - Inspector Number 1 (Rack Man)
#2 - Inspector Number 2 (Diagnostician)

#2 Check lining with lining gauge. Note condition of lining, brake cylinders, wheel bearings and self adjusters.

#1 Re-assemble wheel.

#2 Record all pertinent information on report. Lower jack and place in normal position. Lower hoist. Drive car to Station #5.

STATION #5 SEQUENCE (Time - Approximately 6 minutes)

#2* Drive car from hoist and position car on dynamometer.

#1* Place chocks under front (or rear for front wheel drive) wheels. Raise hood and hook up all scope leads

#2 Place exhaust analyzer in tail pipe and position louvers for best dispersion of exhaust fumes. Return to drivers seat and log any necessary information on Diagnostic report.

#1 Inform #2 man when all connections are made and car is ready to test. Be prepared to give any information requested by #2 man.

#2 Turn key to on position and record ballast resistance.

#1 Turn to 3.6 scale on volt meter; switch toggle switch to point circuit resistance. Read meter and give information to #2 man.

#2 Record information.

#1 Turn volt meter back to 18 volt scale; turn ammeter to x10 scale; switch toggle switch to "circuit ground".

#2 Turn key to "start" position and hold for 15 seconds. Record starter draw and cranking voltage from meters or as read and given by #1 man.

#1 If a second cranking voltage reading is requested by #2 man, hook positive and negative leads to battery and recheck cranking voltage.

#1 Switch toggle switch to center position. Turn dwell/advance meter to advance position. Switch ampmeter to X1 position. Get timing light.

---

* #1 - Inspector Number 1 (Outside Man)
#2 - Inspector Number 2 (Inside Man)

#2	Start engine and run up to 2500 R.P.M. and observe ammeter. Record charging amperage. On cars equipped with TCS, run car in high gear at 2500 R.P.M., according to manufactures procedure. Hold R.P.M. at 2500.
#1	With engine running at 2500 R.P.M. dial in TDC with timing light and note distributor advance on advance meter.
#2	Also note advance reading. Bring engine bacl to idle.
#1	Take basic timing.. Note reading on advance meter.
#2	Also note basic timing reading and record information on diagnostic report.
#1	Switch dwell/advance meter to dwell.
#2	Record dwell reading.
#1	Adjust carburetor linkage to fast idle. Rotate scope pattern selector through each position, noting and relaying any pertinent informaton to #2 man.
#2	Also observe scope patterns for unusual operation in ignition system. Record information and shut off engine.
#1	If positive and negative leads have not already been hooked to battery, do that now. If practical, replace air cleaner.
#2	Test car in prescribed manner, observing the entire scope and panel, making all the necessary entries on the diagnostic report. Bring car to stop.
#1	Pull lever to apply inertia fly wheel.
#2	Test transmission and record operation. Shut off engine. Summarize report and make recommendations.
#1	Disconnect scope leads. Lock hood. Remove chocks. Disconnect exhaust analyzer.
#2	Park car and discuss report with customer.
	End of test.

Total Time Approximately 25 minutes.

IV. FEES

1. Diagnostic Inspection:* Domestic and Foreign Cars -
   $30.00 for members
   35.00 for nonmembers
   Vans -
   33.00 for members
   37.00 for nonmembers

2. Other Services: Other services include the following:

Test Name	Member Fee*	Nonmember Fee*
Brake Test	$10.00	$11.50
Alignment and Suspension	10.00	11.50
Engine Analysis	20.00 (Car) 22.00 (Van)	22.00 (Car) 24.00 (Van)
Automotic Transmission Test	8.50	10.00
Starting & Charging System	10.00	11.50
Rear End and Driveline Test	8.50	10.00
Speedometer Test	6.00	7.50

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* All 1980 fees.

V. TEST EQUIPMENT

1. Brakes: Clayton DB-8-CP Brake dynamometer
2. Alignment: Hunter F-60 Dynamic Alignment Machine
3. Headlight Aim: Hunter 25-34-2 Photoscope: track type
4. Lift: Hunter series 131 with Swing Air Jacks 131-18-1.
5. Emissions Analyzer: Horiba 400A and an Allen analyzer.
6. Engine Analyzer: Clayton Solid State (CSS) 7100 and Allen Smartscope.

7. Dynamometer: Clayton DC-200 Chassis Dynamometer

8. Noise Testing: No equipment.

9. Fuel Economy: Tested indirectly as part of engine analysis.

10. Other: Balkamp 700-1115 Block Checker
    Stant St-255A Radiator Cap Pressure Tester
    Hunter series 138 wheel spinner
    Dresser Wayne WT 228SH7 Air Compressor
    Autoscan 570 Electrical System Tester

11. Technical Library: Large collection of vehicle specifications and reference manuals including Chilton, Chrysler Bulletins, various factory manuals and Mitchell manuals.

VI. FACILITY STAFFING

Eleven full-time employees
Two part-time employees
The staff is organized as follows:
1 - Station Supervisor
1 - Assistant Supervisor
2 - Senior Automotive Technicians
5 - Junior Automotive Technicians
2 - Part-time receptionists (Equivalent to 1 full time position).

VII. TRAINING

1. Employee Training Provisions: The Auto Club will pay the cost of night school classes and NIASE test fees for its employees.

2. Technical Update Meetings: Approximately one meeting per month is held to review any updates or changes in the inspection procedures/techniques.

VIII. QUALITY CONTROL

1. Supervision for Inspector: A principal quality control procedure involves running test cars through the facility and comparing the results with an independent diagnosis prepared in advance by some of the auto club managers.

2. Surveys of Customers Satisfaction: None performed.

3. Criteria for Failure (Standards): Vehicles parameters are compared with manufacturer's specifications. Clayton's published specifications on brake balance are used for the brake performance test.

IX. MOBILE EQUIPMENT

Five mobile vans are currently operating. They are located on a scheduled basis at AAA district offices in Northern California. The five vans provide the following services:

2 - Engine diagnosis with an Allen Diagnostic System II

2 - Car check (battery cables, belts, hoses, tires, fluid levels, lights, carburetion

1 - Emission test for ignition or carburetor problems.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

A reinspection is provided at no charge if the motorist returns to the facility and is still having a problem with the car. The Auto Club does not encourage rechecks following repair for financial reasons.

XI. CUSTOMER INTERFACE

1. Counseling: Approximately 5 to 10 minutes of counseling are provided following the test. Repair recommendations are written on the diagnostic checksheet and given to the customer.

2. Additional Customer Accommodations: All inspection records for customers are held at the diagnostic clinic for 10 years.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time Per Vehicle: Approximately 43 minutes.

2. Time at Each Station:

- Station 1, Underhood Check - 6 minutes
- Station 2, Dynamic Brake Test - 3 minutes
- Station 3, Dynamic Alignment Test - 4 minutes

- Station 4, Underbody Check - 10 minutes
- Station 5, Engine Analysis - 10 minutes
- Counseling - 10 minutes
- Total Test Time - 43 minutes (approximately)

3. Theoretical Maximum Throughput: 39 per day.

4. Average Throughput: 34-35 per day.

5. Appointments Used: Yes - spaced 10 minutes apart

6. Busiest Time of Year: April through June.

7. Maximum Number of Vehicles Processed for the Entire Facility: In 1977, a total of 7,728 cars were inspected, with an average of 644 cars per month.

XIII. INVESTMENT AND OPERATING COSTS

In 1974, the initial equipment costs were $65,000. The initial investment for the building was $385,000 with a total initial investment of $450,000. The facility opened November, 1974.

The total annual operating budget for 1977 was $157,000.

[redacted]

AUTO CLUB CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Names and Address: California State Automobile Association
San Francisco Diagnostic Center
150 Hayes Street
San Francisco, California

2. Contact Name and Number: Don Cosgrove, Manager
Automotive Technical Service
(415) 565-2012

3. General Description of Facility: The CSAA diagnostic inspection facility in San Francisco was built in 1968 and has approximately 2,500 square feet of space. Vehicles enter on one side of the building, progress through three working bays and exit on the otherside of the building. The club offers dynamic brake analysis, dynamic front end analysis, engine analysis while the vehicle is on a dynamometer and other system tests.

4. Vehicle Types Inspected: Primarily passenger cars.

5. Types of Inspection Services: Full diagnostic inspection, no repairs performed.

6. Operating Hours: M-F 7:30 to 5:00 p.m. (Appointments from 8:00 to 4:00)

7. Physical Area of Inspection Facility: 1,680 square feet devoted to inspection with approximately 800 square feet of auxiliary floor space for a total area of 2,480 sq. feet.

8. Inspection Station Dimensions: 62' x 40'

9. Number of Lanes/Bays: 3 bays, each 14' wide x 40' long.

10. Queueing Area: Not needed since appointments are used.

11. Parking Area: Can accomodate 8 cars.

[redacted]

12. Facility Diagram and Location of Equipment: See Figure 1. The diagnostic clinic is located on the first floor of a 7-story building. The other floors are used for parking levels, insurance claims processing and space which is leased to the city telephone utility and waste water engineering offices.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: 1968

2. Patron Accommodations in Addition to Lanes: Customers can view the inspection process through a window.

3. Ventilation System Design: Four Clayton louvres and an exhaust fan system. The pit under the diagnostic rack is ventilated.

4. Safety Accommodations: Safety glass for the viewing area.

5. Noise Accommodations: Lead curtains separate the bays to dampen noise since there is a hospital next door. The customer area uses acoustical double pane glass and sound absorbing tiles. Acoustical tiles are also installed on the walls and ceiling of the inspection area. The dynamometer is equipped with sound deadening rolls.

III. STEPS OF INSPECTION PROCESS

1. Data Handling: The results of the inspection process and recommended repairs are recorded on a diagnostic checklist. An example of a completed form is shown in Figure 2.

2. Inspection Sequence: The general inspection sequence is as follows:

   - General inspection including belts, lights
   - Dynamic brake analysis
   - Dynamic front end analysis
   - Car on lift - underhood checks for leaks, universal joints, spin front wheels
   - Engine analysis while vehicle is on the dynamometer.

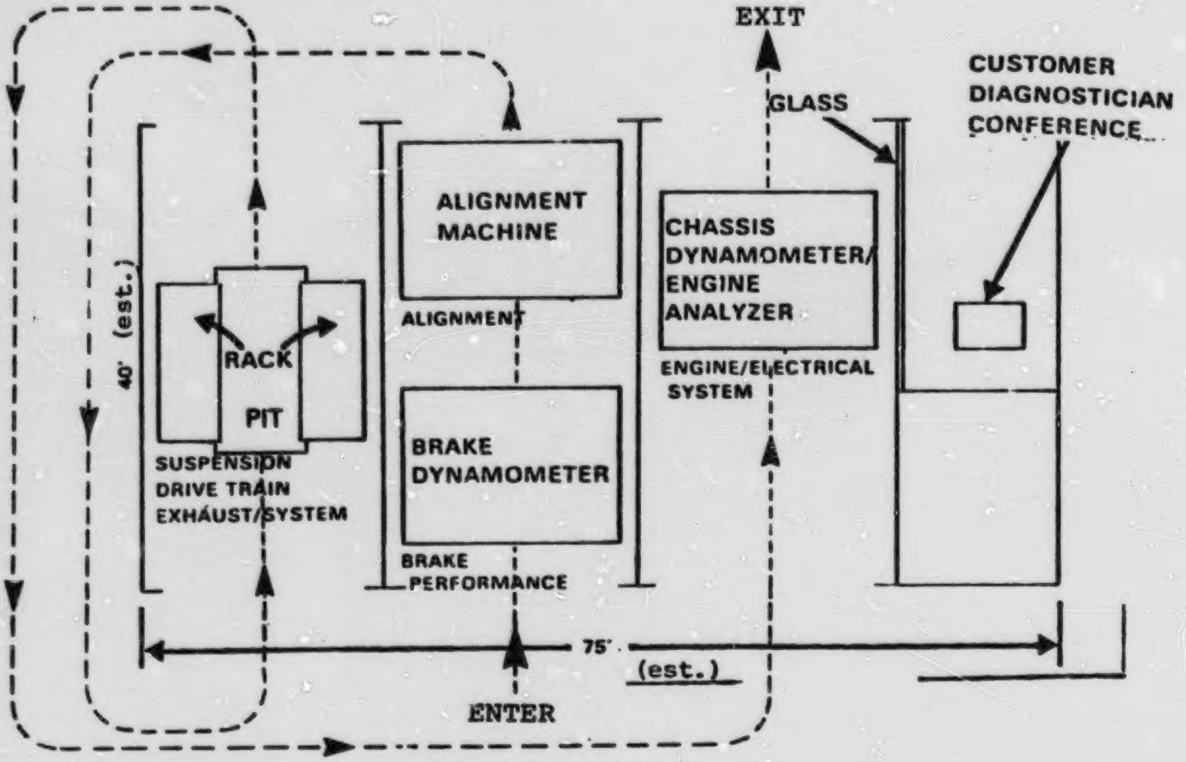
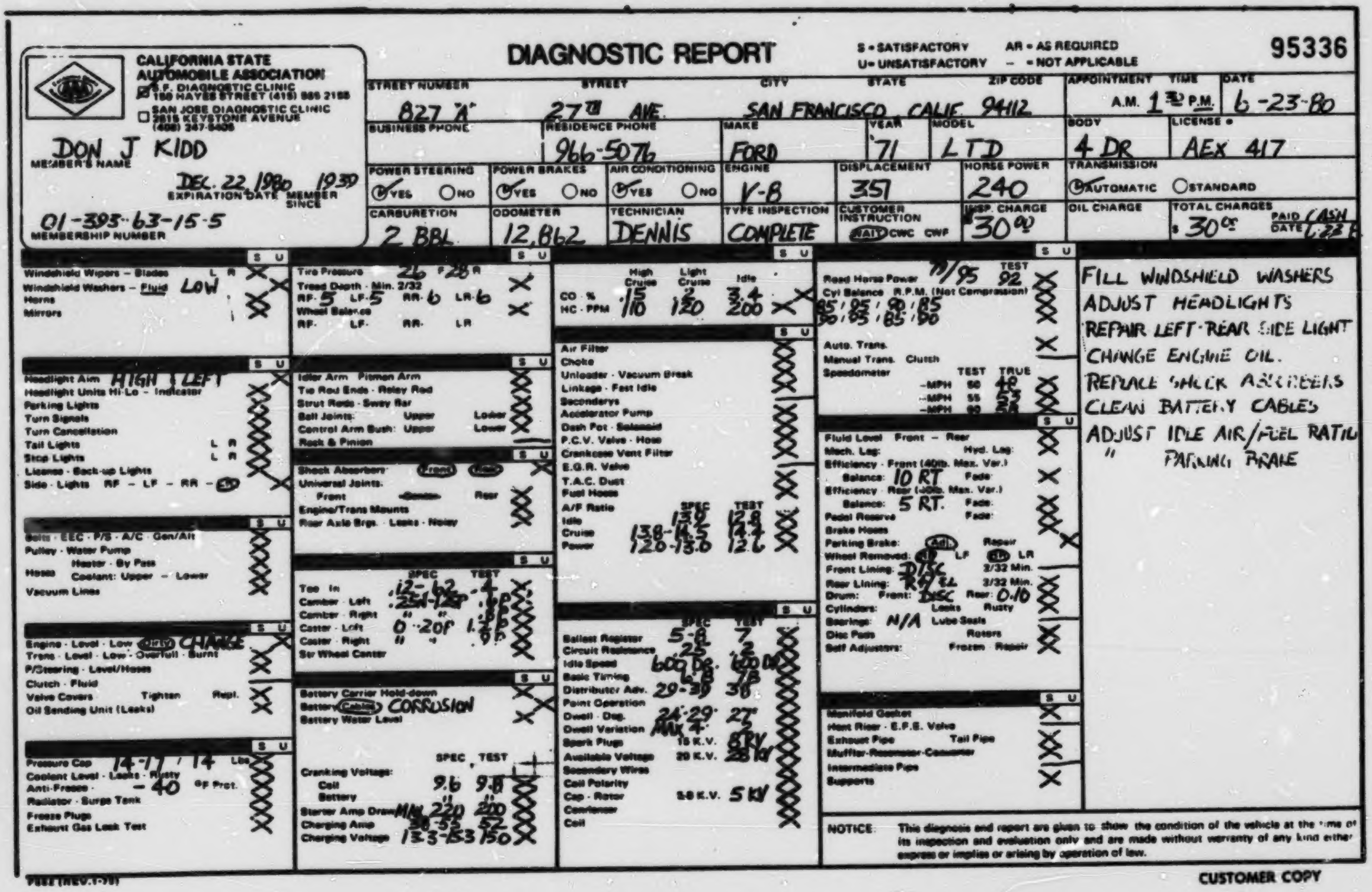

EXIT
CUSTOMER
DIAGNOSTICIAN
CONFERENCE
GLASS
ALIGNMENT
MACHINE
CHASSIS
DYNAMOMETER/
ENGINE
ANALYZER
40' (est.)
RACK
PIT
ALIGNMENT
ENGINE/ELECTRICAL
SYSTEM
BRAKE
DYNAMOMETER
SUSPENSION
DRIVE TRAIN
EXHAUST/SYSTEM
BRAKE
PERFORMANCE
75'
(est.)
ENTER

FIGURE 1. SAN FRANCISCO DIAGNOSTIC FACILITY LAYOUT

BEST DOCUMENT AVAILABLE



CALIFORNIA STATE AUTOMOBILE ASSOCIATION
☑ S.F. DIAGNOSTIC CLINIC 150 HAYES STREET (415) 565 2155
☐ SAN JOSE DIAGNOSTIC CLINIC 3815 KEYSTONE AVENUE (408) 247-5405

MEMBER'S NAME: DON J KIDD
EXPIRATION DATE: DEC. 22, 1980 MEMBER SINCE: 1939
MEMBERSHIP NUMBER: 01-393-63-15-5

DIAGNOSTIC REPORT

S = SATISFACTORY AR = AS REQUIRED
U = UNSATISFACTORY – = NOT APPLICABLE

95336

STREET NUMBER: 827 "A" STREET: 27TH AVE. CITY: SAN FRANCISCO STATE: CALIF. ZIP CODE: 94112
APPOINTMENT TIME: A.M. 1:30 P.M. DATE: 6-23-80
BUSINESS PHONE:
RESIDENCE PHONE: 966-5076
MAKE: FORD YEAR: '71 MODEL: LTD BODY: 4 DR LICENSE #: AEX 417
POWER STEERING: ☑ YES ○ NO POWER BRAKES: ☑ YES ○ NO AIR CONDITIONING: ☑ YES ○ NO
ENGINE: V-8 DISPLACEMENT: 351 HORSE POWER: 240
TRANSMISSION: ☑ AUTOMATIC ○ STANDARD
CARBURETION: 2 BBL ODOMETER: 12,862 TECHNICIAN: DENNIS TYPE INSPECTION: COMPLETE
CUSTOMER INSTRUCTION: [✓ WAIT] CWC CWP
INSP. CHARGE: $30.00 OIL CHARGE:
TOTAL CHARGES: $30.00 PAID: CASH DATE: 6-23-80

Windshield Wipers – Blades L R
Windshield Washers – Fluid LOW
Horns
Mirrors

Headlight Aim HIGH & LEFT
Headlight Units Hi-Lo – Indicator
Parking Lights
Turn Signals
Turn Cancellation
Tail Lights L R
Stop Lights L R
License – Back-up Lights
Side – Lights RF – LF – RR – [✓ LR]

Belts – EEC – P/S – A/C – Gen/Alt
Pulley – Water Pump
Hoses Heater – By Pass
Coolant: Upper – Lower
Vacuum Lines

Engine – Level – Low – [✓ Dirty] CHANGE
Trans – Level – Low – Overfull – Burnt
P/Steering – Level/Hoses
Clutch – Fluid
Valve Covers Tighten Repl.
Oil Sending Unit (Leaks)

Pressure Cap 14-17 / 14 Lbs
Coolant Level – Leaks – Rusty
Anti-Freeze – -40 °F Prot.
Radiator – Surge Tank
Freeze Plugs
Exhaust Gas Leak Test

Tire Pressure 26 F 28 R
Tread Depth – Min. 2/32
RF 5 LF 5 RR 6 LR 6
Wheel Balance
RF LF RR LR

Idler Arm Pitman Arm
Tie Rod Ends – Relay Rod
Strut Rods – Sway Bar
Ball Joints: Upper Lower
Control Arm Bush: Upper Lower
Rack & Pinion

Shock Absorbers: [✓ Front] [✓ Rear]
Universal Joints:
Front ~~Center~~ Rear
Engine/Trans Mounts
Rear Axle Brgs. – Leaks – Noisy

	SPEC	TEST
Toe In	.12-.62	.4
Camber – Left	.25N-1.25P	.5P
Camber – Right	" "	.5P
Caster – Left	0-.20P	1.2P
Caster – Right	" "	.9P
Str Wheel Center		

Battery Carrier Hold-down
Battery [✓ Cables] CORROSION
Battery Water Level

	SPEC	TEST
Cranking Voltage:		
Coil	9.6	9.8
Battery	"	"
Starter Amp Draw	MAX 220	200
Charging Amp	38-55	52
Charging Voltage	13.3-15.3	15.0

	High Cruise	Light Cruise	Idle
CO – %	.15	.2	3.4
HC – PPM	110	120	200

Air Filter
Choke
Unloader – Vacuum Break
Linkage – Fast Idle
Secondarys
Accelerator Pump
Dash Pot – Solenoid
P.C.V. Valve – Hose
Crankcase Vent Filter
E.G.R. Valve
T.A.C. Duct
Fuel Hoses

A/F Ratio	SPEC	TEST
Idle	13.2	12.8
Cruise	13.8-14.5	14.4
Power	12.0-13.0	12.6

	SPEC	TEST
Ballast Register	5-8	7
Circuit Resistance	.25	.2
Idle Speed	600 Dr.	600 Dr.
Basic Timing	6 B	7 B
Distributor Adv.	29-39	36
Point Operation		
Dwell – Deg.	24°-29°	27°
Dwell Variation	MAX 4°	2
Spark Plugs	15 K.V.	8 KV
Available Voltage	20 K.V.	28 KV
Secondary Wires		
Coil Polarity		
Cap – Rotor	2.8 K.V.	5 KV
Condenser		
Coil		

Road Horse Power 77/95 TEST 92
Cyl Balance R.P.M. (Not Compression)
85 / 95 / 90 / 85
90 / 95 / 85 / 90
Auto. Trans.
Manual Trans. Clutch

Speedometer		TEST	TRUE
	–MPH	50	48
	–MPH	55	53
	–MPH	60	58

Fluid Level Front – Rear
Mech. Lag: Hyd. Lag:
Efficiency – Front (40lb. Max. Var.)
Balance: 10 RT Fade:
Efficiency – Rear (40lb. Max. Var.)
Balance: 5 RT. Fade:
Pedal Reserve Fade:
Brake Hoses
Parking Brake: [✓ Adj.] Repair
Wheel Removed: [✓ RF] LF [✓ RR] LR
Front Lining: DISC 2/32 Min.
Rear Lining: RV 8L 2/32 Min.
Drum: Front: DISC Rear: 0.10
Cylinders: Leaks Rusty
Bearings: N/A Lube-Seals
Disc Pads Rotors
Self Adjusters: Frozen Repair

Manifold Gasket
Heat Riser – E.F.E. Valve
Exhaust Pipe Tail Pipe
Muffler-Resonator-Converter
Intermediate Pipe
Supports

FILL WINDSHIELD WASHERS
ADJUST HEADLIGHTS
REPAIR LEFT-REAR SIDE LIGHT
CHANGE ENGINE OIL.
REPLACE SHOCK ABSORBERS
CLEAN BATTERY CABLES
ADJUST IDLE AIR/FUEL RATIO
" PARKING BRAKE

NOTICE: This diagnosis and report are given to show the condition of the vehicle at the time of its inspection and evaluation only and are made without warranty of any kind either express or implied or arising by operation of law.

P552 (REV.1-78)

CUSTOMER COPY

FIGURE 2. SAMPLE DIAGNOSTIC REPORT

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The detailed inspection procedures are similar to those used in the San Jose clinic.

IV. FEES

1. Diagnostic Inspection: Domestic and Foreign cars - $30.00 for members and $35.00 for nonmembers; Vans - $33.00 for members and $37.00 for nonmembers

2. Other Services: Additional inspection services provided by the San Francisco diagnostic clinic are listed in Table 1. (The same services are provided at the San Jose clinic).

V. TEST EQUIPMENT

1. Brakes: Clayton Brake Analyzer

2. Alignment: Merrill Front End Analyzer

3. Headlight Aim: Weaver headlamp tester (WX 4546)

4. Lift: Hunter Diagnostic Rack

5. Emission Analyzer: Sun EPA-75 Emission Analyzer

6. Engine Analyzer: Clayton 7100 Engine Analyzer

7. Dynamometer: Clayton Chassis Dynamometer (C-200)

8. Noise Testing: No equipment

9. Fuel Economy: Tested indirectly as part of engine analysis

10. Other: Wheel Spinner. Ausone M780 Suspension Analyzer (est. cost $1700).

VI. EQUIPMENT MAINTENANCE

1. Frequency of Maintenance: Equipment is checked and maintained daily.

2. Frequency of Gas Calibration for Emission Analyzers: According to manufacturer's specifications.

VII. FACILITY STAFFING

1. Manager Automotive Technical Service: Don Cosgrove

TABLE 1. Additional Inspection Services Provided by the San Francisco Diagnostic Clinic (1980 Fees)

TEST DESCRIPTION	MEMBER FEE	NON-MEMBER FEE
BRAKE TEST	$10.00	$11.50
Brake fluid level		
Efficiency & Balance Test - 4 Wheels		
Inspection of front & rear lining - 2 Wheels		
Inspection of rotors & brake drum		
Inspection of front wheel bearings		
Inspection of braking components		
ALLIGNMENT AND SUSPENSION TEST	10.00	11.50
Measurement of toe-chamber-caster		
Inspection of front tires & tread depth		
Inspection of steering linkage		
Suspension joints		
Front shock absorbers		
Front wheel balance		
ENGINE ANALYSIS TEST*	20.00	22.00
Complete cooling system inspection		
Air Filter		
Carburetor components & internal circuits		
Complete ignition system test		
Power analysis		
Individual cylinder balance		
Exhaust emission analysis		
AUTOMATIC TRANSMISSION TEST	8.50	11.00
Transmission fluid level & evaluation		
Transmission leaks		
Transmission modulator		
Dyno test transmission operation		
STARTING & CHARGING SYSTEM	10.00	11.50
Starter ampers draw		
Battery capacity & load test		
Generator and/or alternator ampereage output		
Charging voltage		
General battery - carrier - hold down & cable		
REAR END AND DRIVELINE TEST	8.50	10.00
Vibration low speeds 35-40 MPH		
SPEEDOMETER TEST	6.00	7.50

* Figure 3 shows an Engine Analysis Report.

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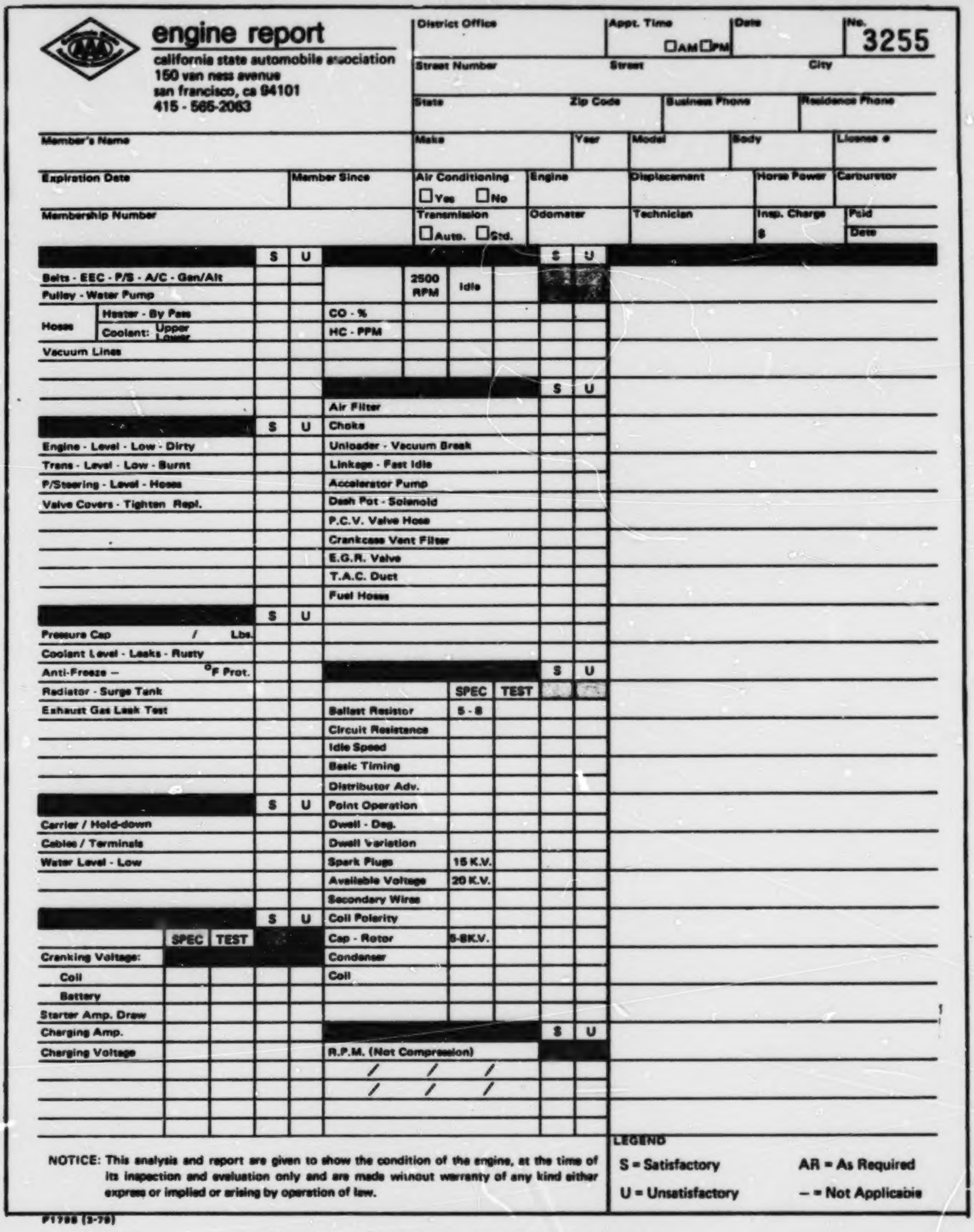

engine report

california state automobile association
150 van ness avenue
san francisco, ca 94101
415 - 565-2063

No. 3255

District Office	Appt. Time ☐AM ☐PM	Date	No. 3255	
Street Number	Street	City		
State	Zip Code	Business Phone	Residence Phone	
Member's Name	Make	Year	Model	Body License #
Expiration Date Member Since	Air Conditioning ☐Yes ☐No	Engine	Displacement	Horse Power Carburetor
Membership Number	Transmission ☐Auto. ☐Std.	Odometer	Technician	Insp. Charge $ Paid Date

	S	U
Belts - EEC - P/S - A/C - Gen/Alt		
Pulley - Water Pump		
Hoses: Heater - By Pass		
Hoses: Coolant: Upper Lower		
Vacuum Lines		

	2500 RPM	Idle		S	U
CO - %					
HC - PPM					

	S	U
Engine - Level - Low - Dirty		
Trans - Level - Low - Burnt		
P/Steering - Level - Hoses		
Valve Covers - Tighten Repl.		

	S	U
Air Filter		
Choke		
Unloader - Vacuum Break		
Linkage - Fast Idle		
Accelerator Pump		
Dash Pot - Solenoid		
P.C.V. Valve Hose		
Crankcase Vent Filter		
E.G.R. Valve		
T.A.C. Duct		
Fuel Hoses		

	S	U
Pressure Cap / Lbs.		
Coolant Level - Leaks - Rusty		
Anti-Freeze — °F Prot.		
Radiator - Surge Tank		
Exhaust Gas Leak Test		

	SPEC	TEST	S	U
Ballast Resistor	5 - 8			
Circuit Resistance				
Idle Speed				
Basic Timing				
Distributor Adv.				
Point Operation				
Dwell - Deg.				
Dwell Variation				
Spark Plugs	15 K.V.			
Available Voltage	20 K.V.			
Secondary Wires				
Coil Polarity				
Cap - Rotor	5-8K.V.			
Condenser				
Coil				

	S	U
Carrier / Hold-down		
Cables / Terminals		
Water Level - Low		

	SPEC	TEST	S	U
Cranking Voltage:				
Coil				
Battery				
Starter Amp. Draw				
Charging Amp.				
Charging Voltage				

	S	U
R.P.M. (Not Compression)		
/ / /		
/ / /		

NOTICE: This analysis and report are given to show the condition of the engine, at the time of its inspection and evaluation only and are made without warranty of any kind either express or implied or arising by operation of law.

LEGEND
S = Satisfactory
AR = As Required
U = Unsatisfactory
— = Not Applicable

P1798 (3-79)

FIGURE 3. ENGINE ANALYSIS REPORT

[redacted]

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2. Station Superviser: Gary Mertle

3. Assistant Superviser: Chuck Kline

4. Senior Technicians*: 3

5. Junior Technicians*: 4

6. Clerical: 2 (part-time) - Equivalent to 1 fulltime position.

VIII. TRAINING

1. Inspector Exerience Requirements: Senior technicians are required to be journeyman-level mechanics with several areas of NIASE certification. Junior technicians must have one to two years of automotive technical training. All inspectors must have a California smog inspector's license.

2. Employee Training Provisions: Hire junior technicians out of Technical School. Train people on the job. Weed out poor performers.

3. Technical Update Meetings: Meetings are held approximately monthly to update inspectors on changes in inspection procedures.

IX. MOBILE EQUIPMENT

The San Francisco Center, together with the San Jose Diagnostic Clinic, operates several mobile diagnostic units. The Mobile vans each perform one of the following services:

- Engine Diagnosis - Engine diagnostic service units are equipped with an Allen 1630 engine analyzer and provide diagnosis of the ignition system, carburetion, exhaust and emission control systems, cylinder balance, cooling system, lubricants and belts. The engine diagnosis takes about 30 minutes and costs approximately $20.00.

---

* All inspections are performed by the junior and senior inspectors.

[redacted]

- Car Check - The Car Check service unit inspects the battery and cables, belts, hoses, tires, carburetion, fluid levels and lights. This simple maintenance check takes about 20 minutes and costs approximately $5.00.

Brochures describing these two services are shown in Figure 4. See also XII, Consumer and Community Relations.

X. CUSTOMER INTERFACE

1. Counseling: Customer has a conference with a diagnostician following the inspection.

2. Additional Customer Accommodations: A glass-enclosed viewing area is provided for the motorists to observe the inspection.

XI. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time Per Vehicle: 30 to 40 minutes for inspection plus 5 to 15 minutes for counseling and processing.

2. Theoretical Maximum Facility Throughput: 35 to 38 vehicles per day.

3. Average Facility Throughput: 30 to 33 vehicles per day.

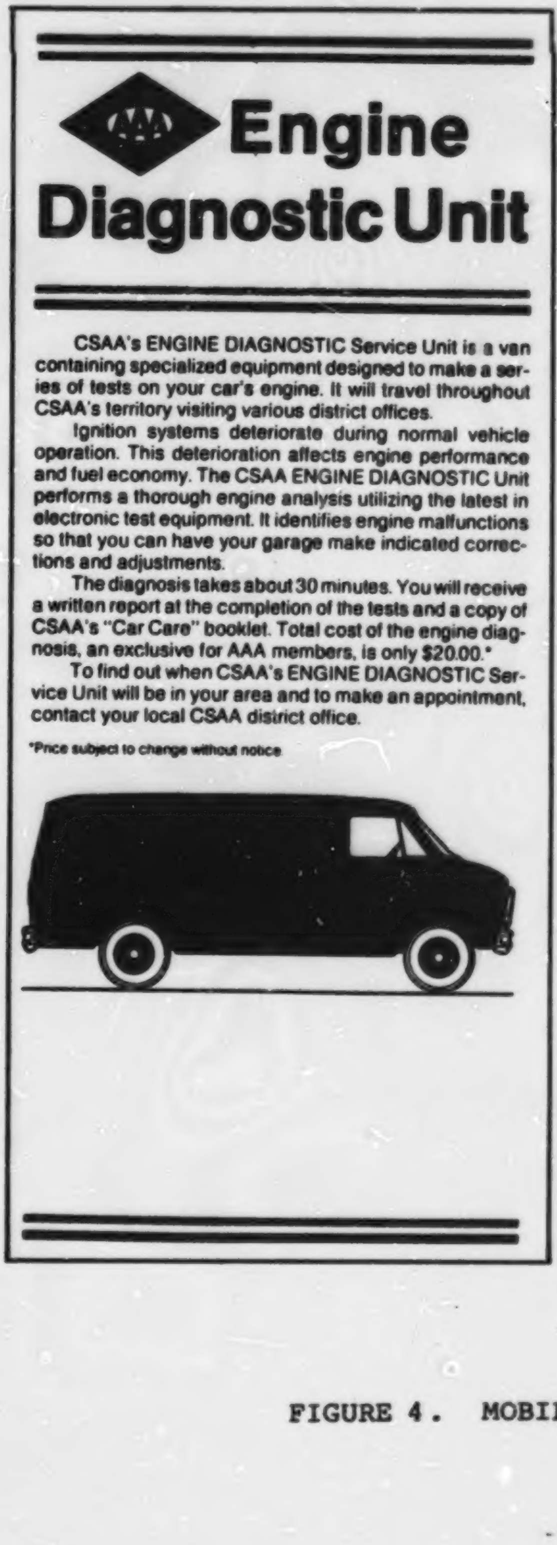
4. Appointments Used: Yes. The backlog in appointments ranges from 7 to 21 days, depending on the time of year.

5. Busiest Time of Year: December (before Christmas) and summer.

6. Maximum Number of Vehicles Processed Per Hour for the Entire Facility: Five vehicle per hour, 35-38 vehicles per day.

XII. CONSUMER AND COMMUNITY RELATIONS

Two consumer/community relations programs which are operated by the California State Automobile Association are the Car Care Class and the Community Gas Savers Program. Each program is described below.



Engine Diagnostic Unit

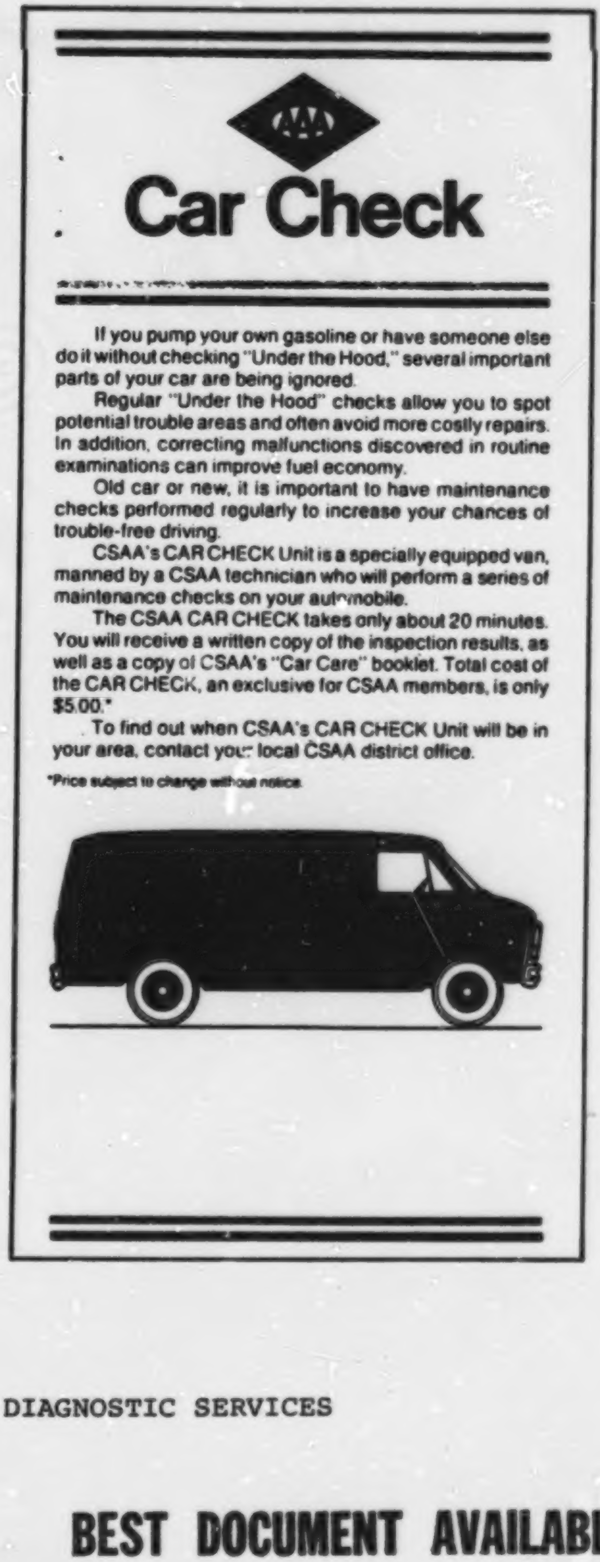
CSAA's ENGINE DIAGNOSTIC Service Unit is a van containing specialized equipment designed to make a series of tests on your car's engine. It will travel throughout CSAA's territory visiting various district offices.

Ignition systems deteriorate during normal vehicle operation. This deterioration affects engine performance and fuel economy. The CSAA ENGINE DIAGNOSTIC Unit performs a thorough engine analysis utilizing the latest in electronic test equipment. It identifies engine malfunctions so that you can have your garage make indicated corrections and adjustments.

The diagnosis takes about 30 minutes. You will receive a written report at the completion of the tests and a copy of CSAA's "Car Care" booklet. Total cost of the engine diagnosis, an exclusive for AAA members, is only $20.00.*

To find out when CSAA's ENGINE DIAGNOSTIC Service Unit will be in your area and to make an appointment, contact your local CSAA district office.

*Price subject to change without notice.



Car Check

If you pump your own gasoline or have someone else do it without checking "Under the Hood," several important parts of your car are being ignored.

Regular "Under the Hood" checks allow you to spot potential trouble areas and often avoid more costly repairs. In addition, correcting malfunctions discovered in routine examinations can improve fuel economy.

Old car or new, it is important to have maintenance checks performed regularly to increase your chances of trouble-free driving.

CSAA's CAR CHECK Unit is a specially equipped van, manned by a CSAA technician who will perform a series of maintenance checks on your automobile.

The CSAA CAR CHECK takes only about 20 minutes. You will receive a written copy of the inspection results, as well as a copy of CSAA's "Car Care" booklet. Total cost of the CAR CHECK, an exclusive for CSAA members, is only $5.00.*

To find out when CSAA's CAR CHECK Unit will be in your area, contact your local CSAA district office.

*Price subject to change without notice.

FIGURE 4. MOBILE DIAGNOSTIC SERVICES

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- Car Care Class. The car care class is offered to acquaint members with automobile components and to help the members develop a basic understanding of how the automobile operates and why it fails for lack of maintenance. The class is held at pre-scheduled locations in the San Francisco area. A van is used to transport the instruction materials. The 3-hour session addresses engine fundamentals, the charging system, the starter system, the ignition system, the cooling system and driving techniques for fuel economy.

- Community Gas Savers Program. The purpose of the Community Gas Savers Program is to reduce gasoline consumption by informing motorists of engine malfunctions that affect fuel economy. To reach as many motorists as possible, this program consists of a mobile van equipped with an infrared exhaust analyzer which travels to various communities and gives free emission tests. Readings are taken at idle and at 2500 rpm and then compared with the manufacturer's specifications. An explanatory handout is given to motorists describing the possible causes of high CO and/or HC readings and the detailed results for each vehicle.

XIII. INITIAL INVESTMENT COSTS

In 1968 when the facility was built, the California State Automobile Association already owned the land. Total initial cost was $500,000 for the building and equipment.

APPENDIX B

COMMERCIAL DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARIES

Page Number

Auto Lab, Mt. Clair, California B-1

Automotive Evaluation Center, Long Beach, California B-8

Automotive Performance Specialist, Newington, Virginia B-17

Avocation Ltd., Merrifield, Virginia B-27

Call Carl, Washington, D.C. B-34

CARDOC, La Mesa, California B-43

Imperial Esso, Toronto, Canada B-53

J.C. Penney's, Wilmington, Delaware B-61

Montgomery Ward, Falls Church, Virginia B-72

United Systems Testing, St. Louis, Missouri B-79

DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. **Facility Name and Address:** Auto Lab
   4250 Holt Road
   Mt. Clair, California

2. **Contact Name and Number:** Vern Erb (Owner)*

3. **General Description of Facility Type:** Light repair/diagnostic facility built by Vern Erb in 1972.

4. **Vehicle Types Inspected:** All American and foreign passenger vehicles. No diesel vehicles. Will inspect vans, wagons, and one-ton trucks.

5. **Types of Inspection Services:** Brake diagnosis, engine/emissions diagnosis, vehicle diagnosis (144 items checked).

6. **Hours of Operation:** M-Sat: 8:00 a.m. to 6:00 p.m.

7. **Physical Area of Inspection Facility:** Diagnostic lane is part of 7-bay repair facility.

8. **Inspection Station Dimensions:** Lane is 20' x 100'.

9. **Number of Lanes:** One lane.

10. **Lane Dimensions:** 20' x 100'.

11. **Queueing Area:** Not required due to appointment system.

12. **Parking Area:** Data not available.

13. **Facility Diagram and Location of Equipment:** See Figure 1.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. **Year Constructed:** 1972.

2. **Construction Type and Material:** Data not available.

3. **Patron Accommodations:** Customer may view entire inspection process from customer viewing area.

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* Owner was willing to make only limited data available for the study.

[redacted]

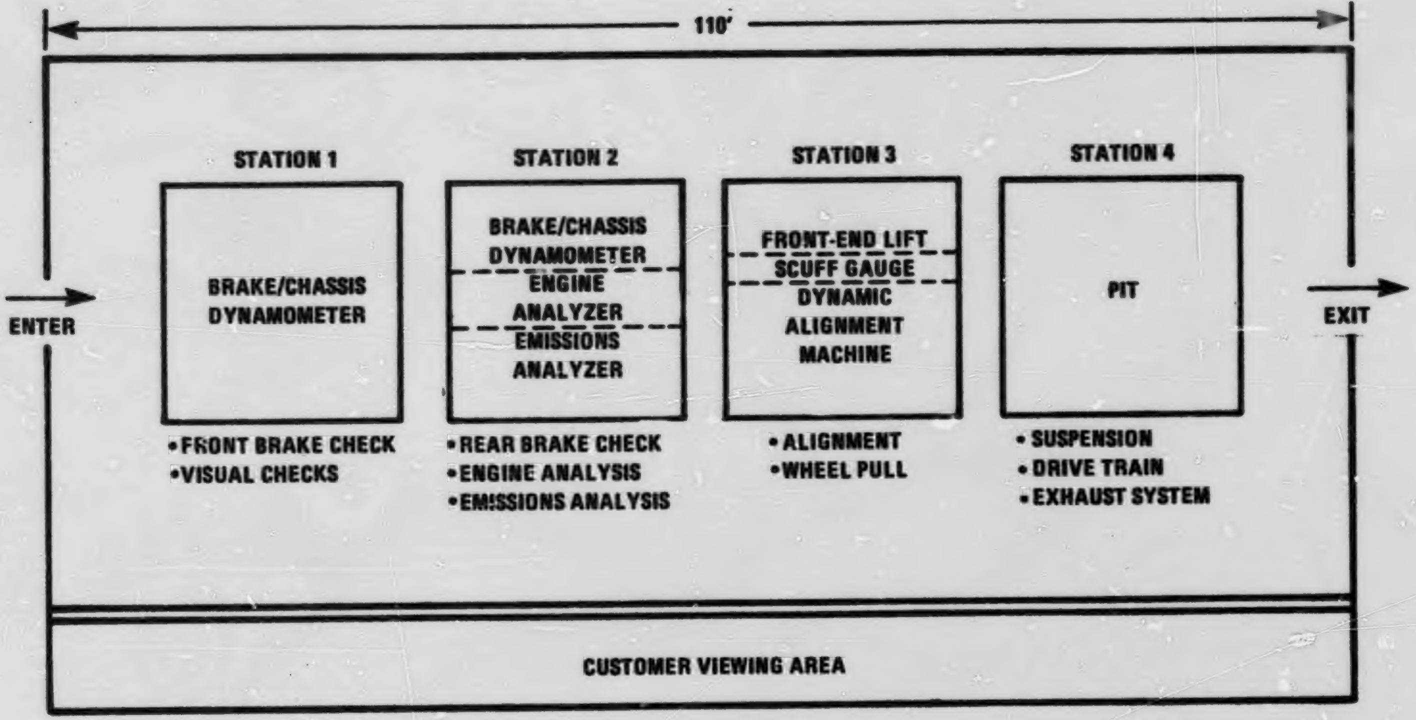
110'
STATION 1
STATION 2
STATION 3
STATION 4
ENTER
BRAKE/CHASSIS DYNAMOMETER
BRAKE/CHASSIS DYNAMOMETER
ENGINE ANALYZER
EMISSIONS ANALYZER
FRONT-END LIFT
SCUFF GAUGE
DYNAMIC ALIGNMENT MACHINE
PIT
EXIT
•FRONT BRAKE CHECK
•VISUAL CHECKS
•REAR BRAKE CHECK
•ENGINE ANALYSIS
•EMISSIONS ANALYSIS
•ALIGNMENT
•WHEEL PULL
•SUSPENSION
•DRIVE TRAIN
•EXHAUST SYSTEM
CUSTOMER VIEWING AREA

FIGURE 1. LAYOUT OF AUTO LAB DIAGNOSTIC LANE

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4. **Ventilation System Design**: Clayton squirrel cage exhaust fan.

5. **Safety Accommodations**: Standard safety procedures are followed.

6. **Noise Accommodations**: Glass-enclosed viewing area.

III. STEPS OF INSPECTION PROCESS

1. **Check-In**: Diagnostician fills out top part of report form on car background.

2. **Test Sequence**:

   - Dynamic brake test (front brakes).
   - Visual safety inspection (horn, headlights, hoses, fluid levels, etc.).
   - Dynamic brake test (rear brakes).
   - Loaded mode engine analysis and emissions check. HC/CO test at idle, 30 and 55 mph. Check speedometer accuracy and horsepower.
   - Front-end lift.
   - Alignment check for toe-in, caster, camber.
   - Two wheels pulled for brake component inspection.
   - Move car to pit area. Undercar check of suspension, drive train and exhaust system.

3. **Data Handling**: Report form is manual checksheet showing "Satisfactory" or "Unsatisfactory" categories.

4. **Check-Out**: Diagnostician explains sheet to customer showing problem areas. Will not give estimate unless asked.

5. **Comments**: Lane flow is speeded up by using an extra scope at Station One to check out the engine electrical system while the vehicle is operating at idle. Thus, at Station Two the engine analysis is only done under loaded conditions. Also, the scuff gauge can detect cars seriously out of alignment without use of the dynamic machine.

[redacted]

IV. FEES

1. Diagnostic Inspection: Automobiles $24.95
Vans $27.95

2. Other Services: Auto Lab has an adjacent repair facility which will perform limited types of repair (brakes, tune-up, valve job).

V. TEST EQUIPMENT*

1. Brakes: Clayton Brake/Chassis Dynamometer.

2. Alignment: Clayton Scuff Gauge
Bear Dynamic Alignment Machine

3. Headlight Aim: None.

4. Lift: Front-end lift.

5. Emissions Analyzer: Marquette.

6. Engine Analyzer: Marquette Engine Analyzer.

7. Dynamometer: See Brakes.

8. Noise Testing: None.

9. Fuel Economy: None.

10. Other: Marquette Alternator/Voltage Regulator.

11. Plans for Replacement: None.

12. Technical Library:

    Chilton manuals
    Mitchell manuals
    Automotive repair shop periodicals.

13. Mobile Equipment: None.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: All equipment maintained as needed.

---

* Model numbers not available.

2. Frequency of Gas Calibration for Emission Analyzer: Calibrated every 3 months by Marquette subsidiary (Test Equipment Co.).

VII. FACILITY STAFFING

1. Program Director: Vern Erb (owner).

2. Station Manager: None.

3. Master Mechanics: Two (repair shop mechanics).

4. Junior Mechanics: None.

5. Diagnosticians: One full-time, one part-time.

6. Aides: None.

7. Clerical:

8. Other: None.

VIII. TRAINING

1. Mechanic Experience Requirements:

   - Must be a licensed mechanic
   - Must have a Class "A" inspection license
   - Must have a California vehicle inspection program license.

2. Employee Training Provisions: Auto Lab is also a training facility for mechanics and diagnosticians. The owner runs a mechanic/diagnosticians school on the premises. Classes are usually small (six people). The courses include VIP State inspection vehicle testing and smog license testing. School graduates around 100 people a year.

3. Technical Update Meetings: Owner keeps up to date by attending seminars, classes and by reading manuals.

IX. QUALITY CONTROL

1. Supervision for Inspectors: The diagnosticians report to the owner if any problems develop.

[redacted]

2. Surveys of Customer Satisfaction: Surveys have been conducted by the California State Automobile Association.*

3. Criteria for Failure: Will use manuals to test for failure.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

No provisions for reinspection exist at this time.

XI. CUSTOMER INTERFACE

1. Counseling: Diagnosticians will counsel the motorist on vehicle's problems (10 minutes) and also provide an estimate of repair costs if it is requested.

2. Additional Customer Accommodations: Customers may observe inspection in the customer viewing area.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time Per Vehicle: 45 minutes (30-35 minutes for inspection, 10 minutes for counseling).

2. Time at Each Station in the Lane:

Station 1: Brake performance test (2 minutes)
Visual and underhood inspection (4 minutes)

Station 2: Emissions/engine analysis (12-15 minutes)

Station 3: Lift. Check front-end, pull wheels (10 minutes)

Station 4: Pit. Check undercar (4 minutes)

3. Theoretical Maximum Throughput: 15-18 per day.

4. Average Throughput: 12 per day.

5. Appointments Used: Yes, with occasional drop-ins.

6. Busiest Time of Year: June - September.

7. Maximum Number of Vehicles Processed per Hour for the Entire Facility: 1.25.

---

* Results not available.

XIII. CONSUMER AND COMMUNITY RELATIONS

Member of: Better Business Bureau
Auto Club of Southern California.

XIV. INVESTMENT AND OPERATING COSTS

Labor Costs:

Head mechanic - $1,200/month
Assistant mechanic - $1,000/month
Diagnostician - $1,600/month.

[redacted]

DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: Automotive Evaluation Center
500 East Wardlow Road
Long Beach, California 90807

2. Contact Name and Number: Joe De Giorgio (Owner)
Gary De Giorgio (Director)
(213) 426-7321

3. General Description of Facility: Automotive Evaluation Center (AEC) is a diagnostic inspection and repair facility started in 1966 by Joe De Giorgio. Mr. De Giorgio has been active in promoting diagnostics and has written a booklet on diagnostics for mechanics. The facility has one diagnostic lane in a separate building and fourteen repair bays located on one lot.

4. Vehicle Types Inspected: All American and some foreign passenger vehicles. No diesels or motorcycles. Will inspect motor homes, vans, and some trucks.

5. Type of Inspection Services: Brake diagnosis, engine diagnosis, vehicle diagnosis.

6. Hours of Operation: Tu.-Fri. 7:30 a.m. - 4:30 p.m.
Sat. 7:00 a.m. - 3:00 p.m.

7. Physical Area of Inspection Facility: Inspection Station is 30' x 40' and located on lot 200' x 150'. The repair bays are in a separate building at end of lot.

8. Inspection Station Dimensions: Station is 30' wide x 40' long.

9. Number of Lanes: One.

10. Lane Dimensions: 18' x 35' (estimated by owner).

11. Queueing Area: Not required due to appointment basis.

12. Parking Area: Can accommodate 40-50 cars.

13. Facility Diagram and Location of Equipment: See Figure 1.

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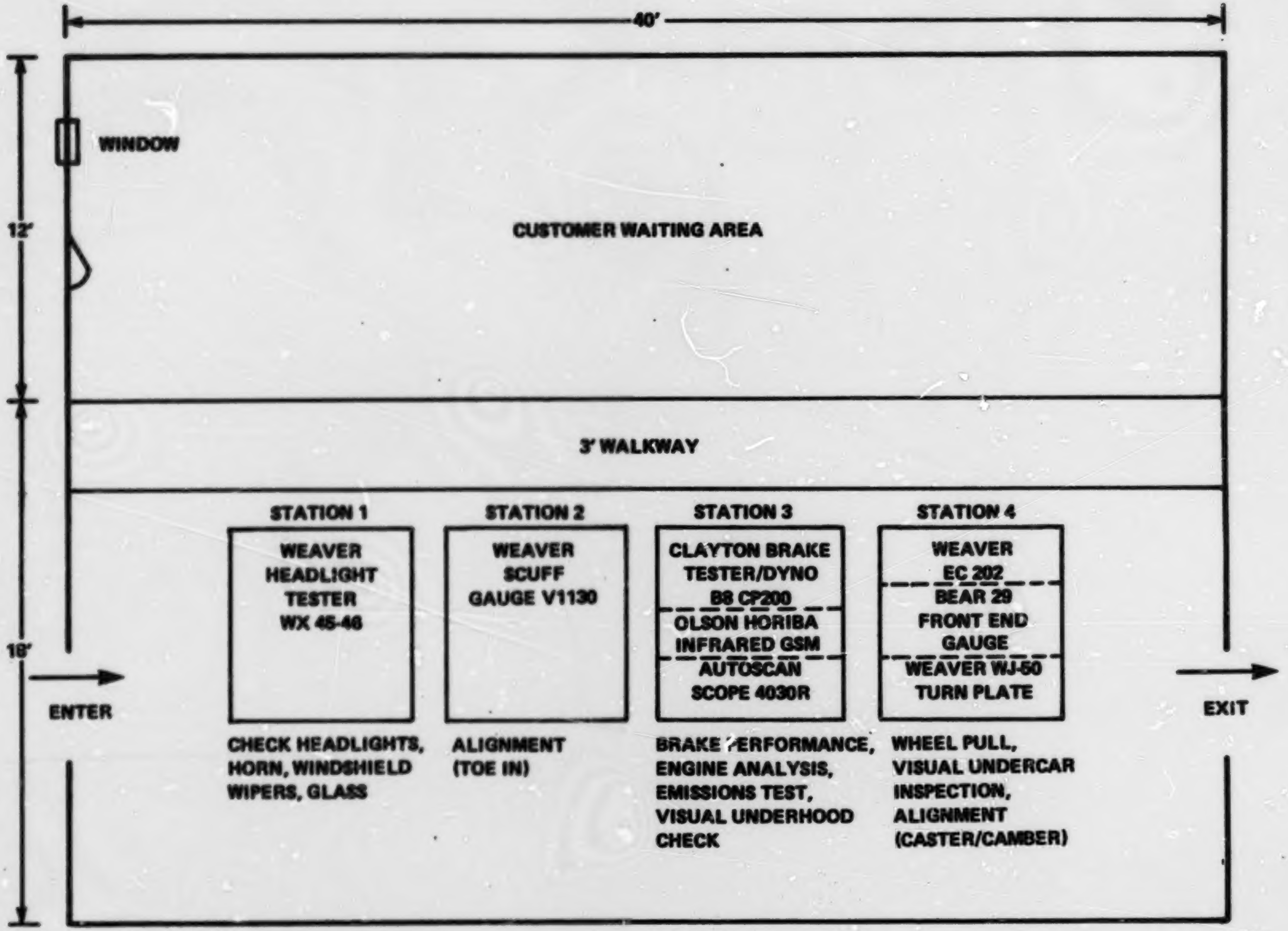
40'
12'
18'
WINDOW
CUSTOMER WAITING AREA
3' WALKWAY
ENTER
EXIT
STATION 1
WEAVER HEADLIGHT TESTER WX 45-46
CHECK HEADLIGHTS, HORN, WINDSHIELD WIPERS, GLASS
STATION 2
WEAVER SCUFF GAUGE V1130
ALIGNMENT (TOE IN)
STATION 3
CLAYTON BRAKE TESTER/DYNO B8 CP200
OLSON HORIBA INFRARED GSM
AUTOSCAN SCOPE 4030R
BRAKE PERFORMANCE, ENGINE ANALYSIS, EMISSIONS TEST, VISUAL UNDERHOOD CHECK
STATION 4
WEAVER EC 202
BEAR 29 FRONT END GAUGE
WEAVER WJ-50 TURN PLATE
WHEEL PULL, VISUAL UNDERCAR INSPECTION, ALIGNMENT (CASTER/CAMBER)

FIGURE 1. FACILITY LAYOUT FOR AUTOMOTIVE EVALUATION CENTER

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. **Year Constructed**: 1966.

2. **Construction Type and Material**: Stucco and wood, Mexican-styled building.

3. **Patron Accommodations**: Air conditioned, customer viewing area with television. Customer may view inspection from lounge or along railed walkway.

4. **Ventilation System Design**: No special ventilation.

5. **Safety Accommodations**: Four-inch curb on each side of the lane.

6. **Noise Accommodations**: Glass-enclosed customer lounge.

III. STEPS OF INSPECTION PROCESS

1. **Check-In**: The clerk fills out top part and "Basic Complaint" section of report sheet (see Figure 2).

2. **Test Sequence**:

   - Headlight test and visual inspection for safety items such as horn, windshield wipers and tires (5 minutes)
   - Alignment test for toe-in (1 minute)
   - Dynamic brake test, engine analysis, exhaust analysis at idle, 3,000-3,500 r.p.m. up to 60 m.p.h., underhood visual check (battery, fluids, hoses, etc.), transmission (36 minutes)
   - Vehicle on lift, under-car visual inspection (fuel lines, exhaust, suspension, muffler, shocks, bearings), pull two left wheels, conduct turn plate test for caster, camber (12 minutes)
   - Road test

3. **Data Handling**: Manual checksheet clinic report form.

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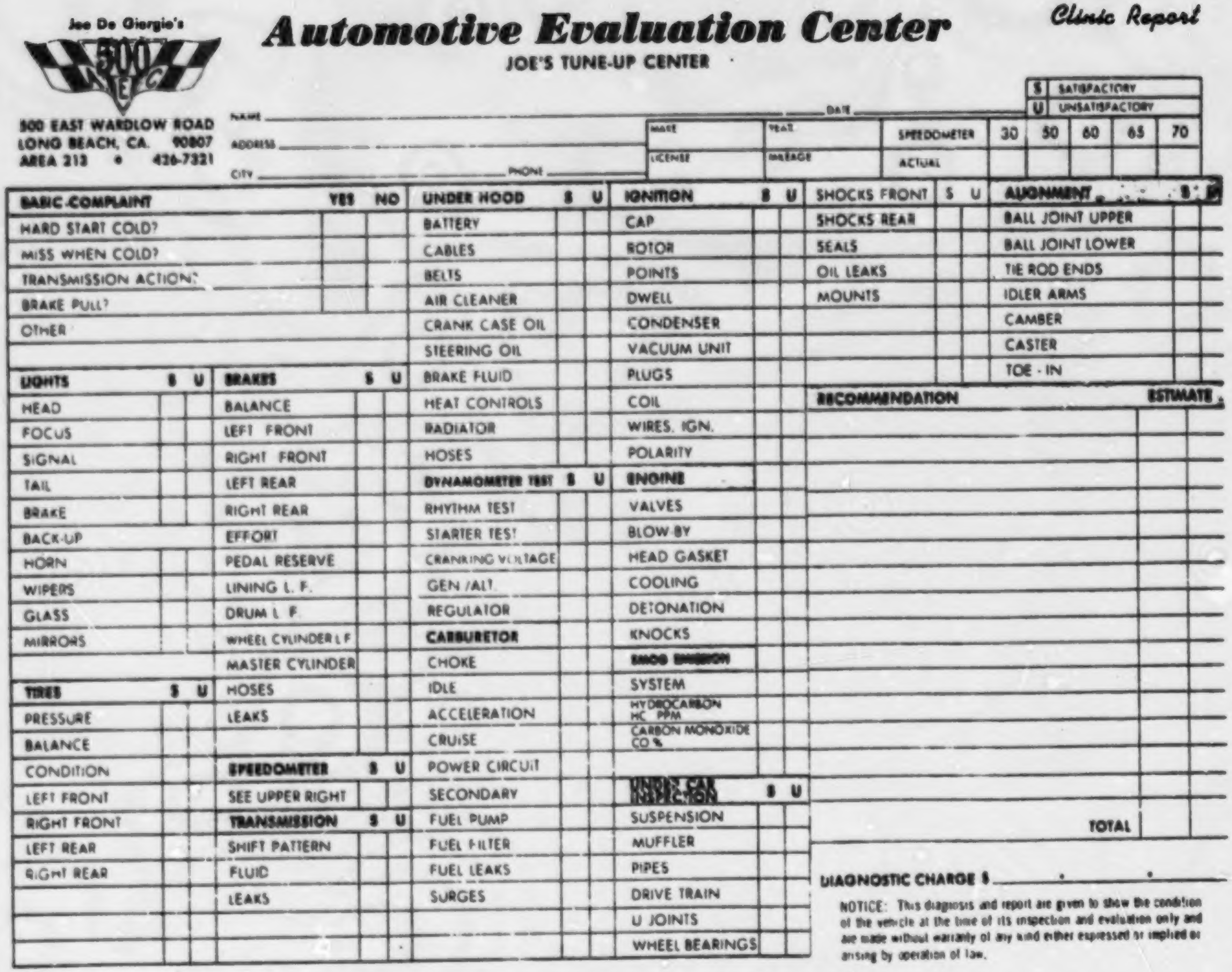

Joe De Giorgio's

500 AEC

500 EAST WARDLOW ROAD
LONG BEACH, CA. 90807
AREA 213 • 426-7321

Automotive Evaluation Center

JOE'S TUNE-UP CENTER

Clinic Report

S	SATISFACTORY
U	UNSATISFACTORY

NAME ____________________ DATE ____________
ADDRESS ____________________
CITY ____________________ PHONE ____________

MAKE	YEAR	SPEEDOMETER	30	50	60	65	70
LICENSE	MILEAGE	ACTUAL					

BASIC COMPLAINT	YES	NO
HARD START COLD?		
MISS WHEN COLD?		
TRANSMISSION ACTION?		
BRAKE PULL?		
OTHER		

LIGHTS	S	U
HEAD		
FOCUS		
SIGNAL		
TAIL		
BRAKE		
BACK-UP		
HORN		
WIPERS		
GLASS		
MIRRORS		

TIRES	S	U
PRESSURE		
BALANCE		
CONDITION		
LEFT FRONT		
RIGHT FRONT		
LEFT REAR		
RIGHT REAR		

BRAKES	S	U
BALANCE		
LEFT FRONT		
RIGHT FRONT		
LEFT REAR		
RIGHT REAR		
EFFORT		
PEDAL RESERVE		
LINING L. F.		
DRUM L. F.		
WHEEL CYLINDER L F		
MASTER CYLINDER		
HOSES		
LEAKS		

SPEEDOMETER	S	U
SEE UPPER RIGHT		

TRANSMISSION	S	U
SHIFT PATTERN		
FLUID		
LEAKS		

UNDER HOOD	S	U
BATTERY		
CABLES		
BELTS		
AIR CLEANER		
CRANK CASE OIL		
STEERING OIL		
BRAKE FLUID		
HEAT CONTROLS		
RADIATOR		
HOSES		

DYNAMOMETER TEST	S	U
RHYTHM TEST		
STARTER TEST		
CRANKING VOLTAGE		
GEN /ALT.		
REGULATOR		

CARBURETOR		
CHOKE		
IDLE		
ACCELERATION		
CRUISE		
POWER CIRCUIT		
SECONDARY		
FUEL PUMP		
FUEL FILTER		
FUEL LEAKS		
SURGES		

IGNITION	S	U
CAP		
ROTOR		
POINTS		
DWELL		
CONDENSER		
VACUUM UNIT		
PLUGS		
COIL		
WIRES, IGN.		
POLARITY		

ENGINE		
VALVES		
BLOW-BY		
HEAD GASKET		
COOLING		
DETONATION		
KNOCKS		

SMOG EMISSION		
SYSTEM		
HYDROCARBON HC PPM		
CARBON MONOXIDE CO %		

UNDER CAR INSPECTION	S	U
SUSPENSION		
MUFFLER		
PIPES		
DRIVE TRAIN		
U JOINTS		
WHEEL BEARINGS		

SHOCKS FRONT	S	U
SHOCKS REAR		
SEALS		
OIL LEAKS		
MOUNTS		

ALIGNMENT	S	U
BALL JOINT UPPER		
BALL JOINT LOWER		
TIE ROD ENDS		
IDLER ARMS		
CAMBER		
CASTER		
TOE - IN		

RECOMMENDATION	ESTIMATE	
TOTAL		

DIAGNOSTIC CHARGE $ ____________

NOTICE: This diagnosis and report are given to show the condition of the vehicle at the time of its inspection and evaluation only and are made without warranty of any kind either expressed or implied or arising by operation of law.

FIGURE 2. AUTOMOTIVE EVALUATION CENTER CLINIC REPORT

4. Check-Out: Diagnostician explains entire inspection sheet to customer, putting most important repairs in "Recommendation" section of report. The diagnostician will prepare best estimate for necessary repairs and help select the type of repair center.

5. Comment: AEC has tried to keep inspection as unbiased as possible by limiting its repair services to brakework, front-ends and tune-ups. AEC maintains that they have no affiliations with or endorsement of any other repair facilities, in order to keep an objective inspection.

IV. FEES

1. Diagnostic Inspection: $21.00 for domestic cars
   $23.00 for foreign cars

2. Other Services: Repairs, including front-end work, brakes, tune-ups.

V. TEST EQUIPMENT

1. Brakes: (One) Clayton Combination Brake Tester/Dynamometer B8 CP200.

2. Alignment: (One) Weaver Scuff Gauge V1130
   (One) Bear 29 Magnetic Gauge (for caster and camber).

3. Headlight Aim: (One) Weaver Headlight Tester WX45-46.

4. Lift: (One) Weaver EC 202.

5. Emissions Analyzer: (One) Clayton 10-30 Analyzer.

6. Engine Analyzer: Autoscan 4030 R.

7. Dynamometer: See Brakes.

8. Noise Testing: None.

9. Fuel Economy: None.

10. Other: Weaver WJ50 Turnplate.

[redacted]

11. Plans for Replacement: Replaced engine analyzer during summer of 1980.

12. Technical Library:

National manuals (foreign and American cars)
Chilton Parts and Labor Manual
Motor
Motor Age

13. Mobile Equipment: The facility does not operate mobile equipment.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Maintenance: Dynamometer is calibrated every six months.

2. Frequency of Gas Calibration for Emission Analyzer: Every two to three weeks.

VII. FACILITY STAFFING

1. Program Director: One - Joe De Giorgio.

2. Station Manager: One - Gary De Giorgio.

3. Master Mechanics: Five.

4. Junior Mechanics: None.

5. Diagnosticians: One.

6. Aides: One.

7. Clerical: Two.

8. Other: None.

VIII. TRAINING

1. Mechanic Experience Requirements: Mechanics have been with AEC for "many years." All have California "A" (smog) license.

2. Employee Training Provisions: Mechanics are trained on the job.

3. Technical Update Meetings: Gary De Giorgio keeps abreast through periodicals and literature. Holds meetings to instruct mechanics as needed.

IX. QUALITY CONTROL

1. Supervision for Inspectors: Station manager will occasionally check the work of the diagnosticians.

2. Surveys of Consumer Satisfaction: Auto Club of Southern California checks the facility twice a year.*

3. Criteria for Failure: Test cars against National manuals and California emission standards. Mechanics make judgments based on automotive experience.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

- After repairs, the car is returned to the dynamometer and checked to make sure the proper repairs have been made.
- After inspection and repair the customer is invited to return for a free recheck and adjustment after approximately 250 miles of driving.
- The customer is asked to return for a free recheck at any time he experiences erratic engine performance or before a long trip. Minor adjustments, such as idle speed adjustment, are free.

XI. CUSTOMER INTERFACE

1. Counseling: Diagnostician reviews the clinic report with the customer, explains the unsatisfactory items, and makes recommendations and estimate of repairs, as shown in Figure 3.

2. Additional Customer Services: AEC will help motorist select a repair facility. (See "Check-Out" and "Comment" section under "III. STEPS OF INSPECTION PROCESS".)

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: 45 to 60 minutes.

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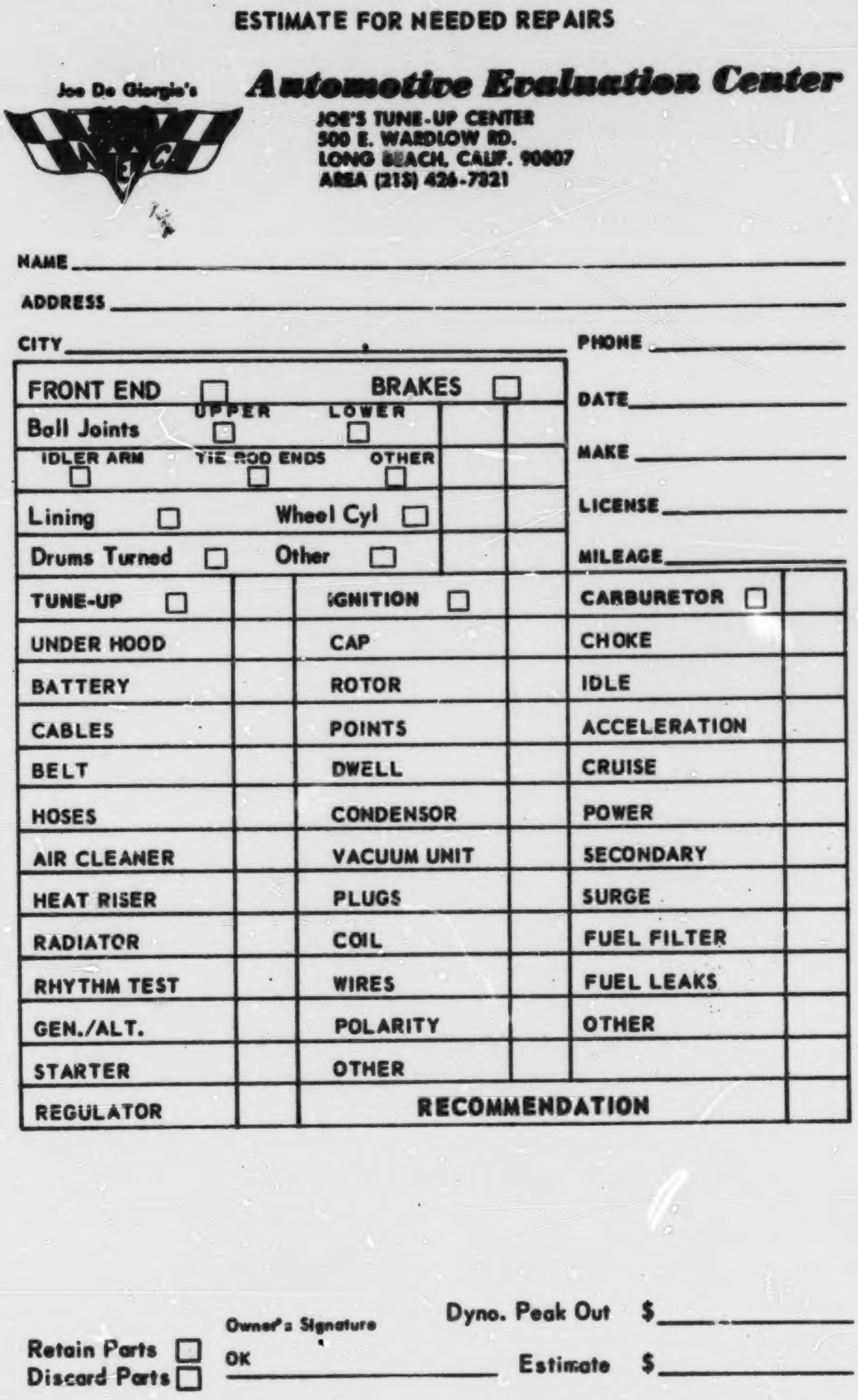
* Results not available.



ESTIMATE FOR NEEDED REPAIRS

Joe De Giorgio's

Automotive Evaluation Center

JOE'S TUNE-UP CENTER
500 E. WARDLOW RD.
LONG BEACH, CALIF. 90807
AREA (213) 426-7321

NAME ______________________________

ADDRESS ______________________________

CITY ____________________ , ____________ PHONE ______________

DATE ______________

MAKE ______________

LICENSE ______________

MILEAGE ______________

FRONT END ☐	BRAKES ☐		
Ball Joints UPPER ☐	LOWER ☐		
IDLER ARM ☐	TIE ROD ENDS ☐ OTHER ☐		
Lining ☐	Wheel Cyl ☐		
Drums Turned ☐	Other ☐		

TUNE-UP ☐		IGNITION ☐		CARBURETOR ☐	
UNDER HOOD		CAP		CHOKE	
BATTERY		ROTOR		IDLE	
CABLES		POINTS		ACCELERATION	
BELT		DWELL		CRUISE	
HOSES		CONDENSOR		POWER	
AIR CLEANER		VACUUM UNIT		SECONDARY	
HEAT RISER		PLUGS		SURGE	
RADIATOR		COIL		FUEL FILTER	
RHYTHM TEST		WIRES		FUEL LEAKS	
GEN./ALT.		POLARITY		OTHER	
STARTER		OTHER			
REGULATOR		RECOMMENDATION			

Retain Parts ☐
Discard Parts ☐

Owner's Signature
OK ______________________

Dyno. Peak Out $______________

Estimate $______________

FIGURE 3. AUTOMOTIVE EVALUATION CENTER ESTIMATE FOR REPAIRS

BEST DOCUMENT AVAILABLE

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2. Time at Each Station in the Lane:

   - Headlight test and visual inspection (5 minutes)
   - Alignment test (1 minute)
   - Dynamic brake test, engine/exhaust analysis (36 minutes)
   - Lift, undercar check (12 minutes).

3. Theoretical Maximum Throughput: 10 vehicles/day.

4. Average Throughput: 9-10 vehicles/day.

5. Appointments Used: Yes. There is usually a 2-3 week backlog of appointments.

6. Busiest Time of Year: Continuous.

7. Maximum Number of Vehicles Processed per Hour for the Entire Facility: Two.

XIII. CONSUMER AND COMMUNITY RELATIONS

Member of:

- Better Business Bureau
- Chamber of Commerce.

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment:

   Facility - $25,000 (1966)
   Equipment- 28,000 (1966)

   Total - $53,000

2. Current Average Hourly Labor Rate: (paid by motorist)

   $21/hr. Domestic cars
   23/hr. Foreign cars

[redacted]

DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. **Facility Name and Address:** Automotive Performance Specialists
8419-D Terminal Road
Newington, Virginia

2. **Contact Name and Number:**
   - Greg Miller (owner/mechanic)
   - David Brosius
   - Larry Fary
   - Betsey Dorman

   (703) 550-7747.

3. **General Description of Facility:** Repair shop offers both diagnostic inspection and repairs. APS diagnostic inspection service is used largely by people who purchase used cars and want them checked. Most of APS' equipment consists of Snap-on tools and test equipment. Repairs are the main source of employment as the number of diagnostic inspections varies. APS is located in an industrial park.

4. **Vehicle Types Inspected:** All American passenger vehicles and light-duty trucks. Some foreign vehicles. No diesels. No tractor trailers.

5. **Types of Inspection Services:** Brake diagnosis, engine diagnosis, vehicle diagnosis (100 items listed on Vehicle Diagnostic Report, but more checked), road check.

6. **Hours of Operation:** M-F 7:00 a.m. to 6:00 p.m.
Sat. 9:00 a.m. to 1:00 p.m.

7. **Physical Area of Inspection Facility:** Inspection station totals 3,900 square feet. Facility lot totals 6,400 square feet. Facility is a warehouse structure located in an industrial village.

8. **Inspection Station Dimensions:** 40' x 100' building.

9. **Number of Bays:** Can fit about 5 cars in work area, diagonally spaced.

10. **Bay Dimensions:** Each bay is approximately 10' x 23'.

[redacted]

11. Queueing Area: Not required since most times car is left or parked in front parking.

12. Parking Area: Can accommodate 10-12 cars.

13. Facility Diagram and Location of Equipment: See Figure 1.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: Between 1965 and 1970.

2. Construction Type and Material: Large cinder block warehouse with concrete floor and metal ceiling.

3. Patron Accommodations: Customer lounge is part of office area. Lounge has couch, radio. Inspection not visible from lounge.

4. Ventilation System Design: One large ceiling exhaust fan with vents in roof.

5. Safety Accommodations: No special safety devices.

6. Noise Accommodations: None.

III. STEPS OF INSPECTION PROCESS

1. Check-In: Customer discussion with diagnostician. Diagnostician fills out top part of report, describing vehicle make, mileage.

2. Test Procedures:

- See Figure 2 for Diagnostic Report Form
- Visual inspection: tires, windshield, emergency brake, headlight, horn, parking lights, turn signals, door latches, fenders, tag lights, window glass
- Car jacked-up:*
    - pull all 4 wheels
    - check wheel cylinders, brake lines, ball joints, tie rods
    - check exhaust system, transmission
- Visual underhood check: check cooling system, fluid levels, belts, hoses, general underhood condition

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* The facility is not equipped with a lift.

[redacted]

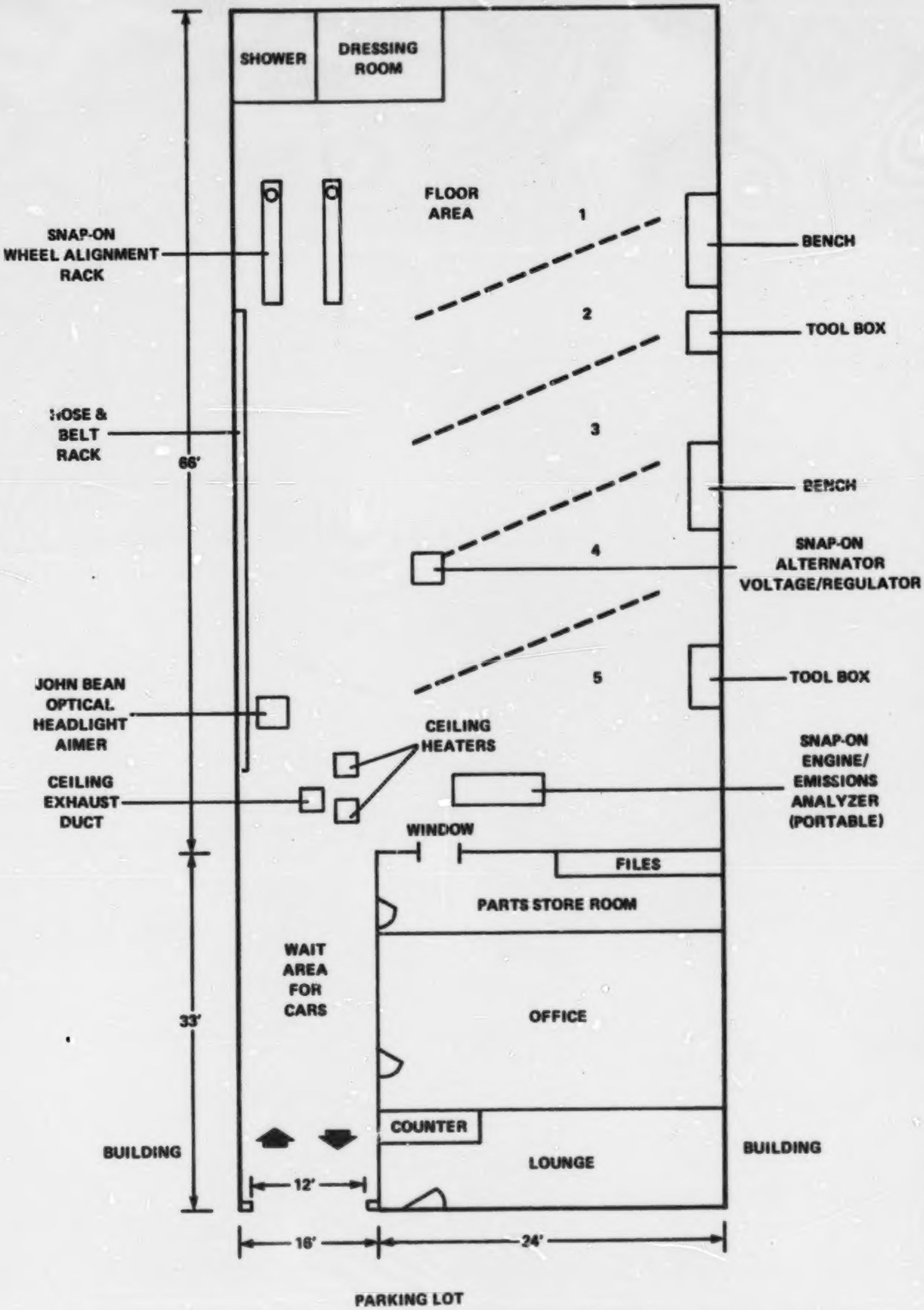
SHOWER
DRESSING ROOM
FLOOR AREA
1
2
3
4
5
SNAP-ON WHEEL ALIGNMENT RACK
BENCH
TOOL BOX
HOSE & BELT RACK
66'
BENCH
SNAP-ON ALTERNATOR VOLTAGE/REGULATOR
TOOL BOX
JOHN BEAN OPTICAL HEADLIGHT AIMER
CEILING HEATERS
SNAP-ON ENGINE/ EMISSIONS ANALYZER (PORTABLE)
CEILING EXHAUST DUCT
WINDOW
FILES
PARTS STORE ROOM
WAIT AREA FOR CARS
OFFICE
33'
COUNTER
LOUNGE
BUILDING
BUILDING
12'
16'
24'
PARKING LOT

FIGURE 1. LAYOUT FOR AUTOMOTIVE PERFORMANCE SPECIALISTS

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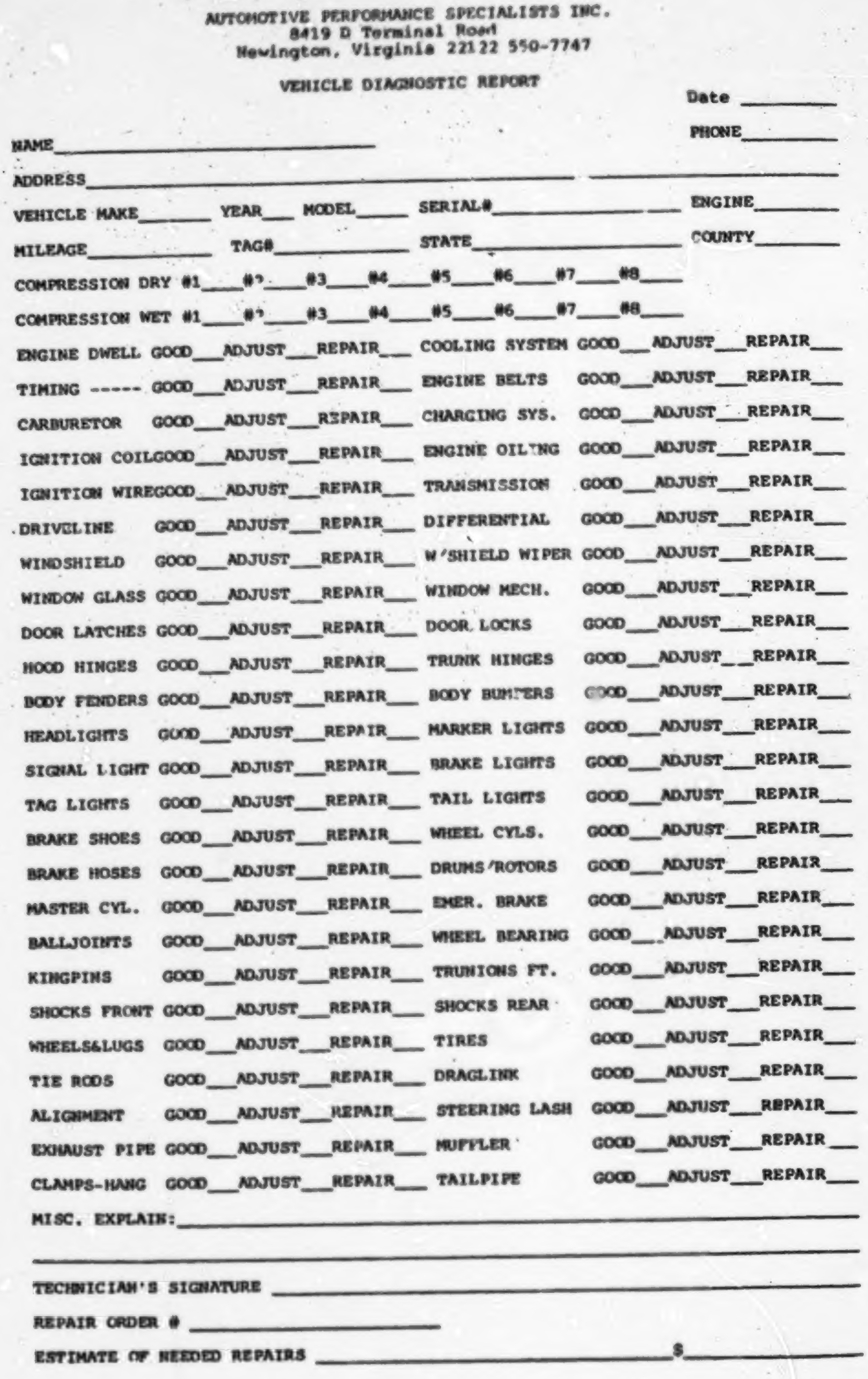

AUTOMOTIVE PERFORMANCE SPECIALISTS INC.
8419 D Terminal Road
Newington, Virginia 22122 550-7747

VEHICLE DIAGNOSTIC REPORT

Date ________

PHONE________

NAME________________________________

ADDRESS____ __________________________

VEHICLE MAKE_______ YEAR___ MODEL_____ SERIAL#___________________ ENGINE________

MILEAGE____________ TAG#____________ STATE____________________ COUNTY________

COMPRESSION DRY #1___ #2___ #3___ #4___ #5___ #6___ #7___ #8___

COMPRESSION WET #1___ #2___ #3___ #4___ #5___ #6___ #7___ #8___

ENGINE DWELL GOOD___ADJUST___REPAIR___ COOLING SYSTEM GOOD___ADJUST___REPAIR___

TIMING ----- GOOD___ADJUST___REPAIR___ ENGINE BELTS GOOD___ADJUST___REPAIR___

CARBURETOR GOOD___ADJUST___REPAIR___ CHARGING SYS. GOOD___ADJUST___REPAIR___

IGNITION COILGOOD___ADJUST___REPAIR___ ENGINE OILING GOOD___ADJUST___REPAIR___

IGNITION WIREGOOD___ADJUST___REPAIR___ TRANSMISSION GOOD___ADJUST___REPAIR___

DRIVELINE GOOD___ADJUST___REPAIR___ DIFFERENTIAL GOOD___ADJUST___REPAIR___

WINDSHIELD GOOD___ADJUST___REPAIR___ W/SHIELD WIPER GOOD___ADJUST___REPAIR___

WINDOW GLASS GOOD___ADJUST___REPAIR___ WINDOW MECH. GOOD___ADJUST___REPAIR___

DOOR LATCHES GOOD___ADJUST___REPAIR___ DOOR LOCKS GOOD___ADJUST___REPAIR___

HOOD HINGES GOOD___ADJUST___REPAIR___ TRUNK HINGES GOOD___ADJUST___REPAIR___

BODY FENDERS GOOD___ADJUST___REPAIR___ BODY BUMPERS GOOD___ADJUST___REPAIR___

HEADLIGHTS GOOD___ADJUST___REPAIR___ MARKER LIGHTS GOOD___ADJUST___REPAIR___

SIGNAL LIGHT GOOD___ADJUST___REPAIR___ BRAKE LIGHTS GOOD___ADJUST___REPAIR___

TAG LIGHTS GOOD___ADJUST___REPAIR___ TAIL LIGHTS GOOD___ADJUST___REPAIR___

BRAKE SHOES GOOD___ADJUST___REPAIR___ WHEEL CYLS. GOOD___ADJUST___REPAIR___

BRAKE HOSES GOOD___ADJUST___REPAIR___ DRUMS/ROTORS GOOD___ADJUST___REPAIR___

MASTER CYL. GOOD___ADJUST___REPAIR___ EMER. BRAKE GOOD___ADJUST___REPAIR___

BALLJOINTS GOOD___ADJUST___REPAIR___ WHEEL BEARING GOOD___ADJUST___REPAIR___

KINGPINS GOOD___ADJUST___REPAIR___ TRUNIONS FT. GOOD___ADJUST___REPAIR___

SHOCKS FRONT GOOD___ADJUST___REPAIR___ SHOCKS REAR GOOD___ADJUST___REPAIR___

WHEELS&LUGS GOOD___ADJUST___REPAIR___ TIRES GOOD___ADJUST___REPAIR___

TIE RODS GOOD___ADJUST___REPAIR___ DRAGLINK GOOD___ADJUST___REPAIR___

ALIGNMENT GOOD___ADJUST___REPAIR___ STEERING LASH GOOD___ADJUST___REPAIR___

EXHAUST PIPE GOOD___ADJUST___REPAIR___ MUFFLER GOOD___ADJUST___REPAIR___

CLAMPS-HANG GOOD___ADJUST___REPAIR___ TAILPIPE GOOD___ADJUST___REPAIR___

MISC. EXPLAIN:____

____

TECHNICIAN'S SIGNATURE ____

REPAIR ORDER # ______________________

ESTIMATE OF NEEDED REPAIRS _______________________________$_______________

FIGURE 2. AUTOMOTIVE PERFORMANCE SPECIALISTS REPORT

BEST DOCUMENT AVAILABLE

- Front-end alignment
- Engine/emissions analysis
- Road test (one mile). Check shift points, hesitation.

3. Data Handling: Report form is manual checklist using "Good/Adjust/Repair" categories. APS transfers all Adjust/Repair items onto "Repair" form which is kept at APS. (See Figure 3)

4. Check-Out: Diagnostician reviews report form with customer (10-15 min.), identifies any critical areas, prioritizes the problems, writes a repair order. Greg Miller will usually make estimate.

5. Comments: Inspection is not done in any prescribed order or location within the shop. Report form is not a complete summary of inspected items.

IV. FEES

1. Diagnostic Inspection:

Complete diagnosis	$30.00 cars 40.00 vans
Diagnostic inspection with compression problem	$40.00
Engine test (only)	$15.00.

2. Other Services: Broad range of repairs and corresponding fees available to customer (10 percent of motorists have repairs performed following the diagnostic check.) APS is a Virginia State Inspection Center.

V. EQUIPMENT

1. Brakes: None.

2. Alignment: (One) Snap-on Wheel Alignment Rack WA-201C.

3. Headlight Aim: (One) John Beam 270-271.

4. Lift: (One) Weaver Air Jack.

5. Emission Analyzer: None.

6. Engine Analyzer: (One) Snap-on Performance Analyzer, MT 4975. (One) Snap-on Oscilloscope MT-665.

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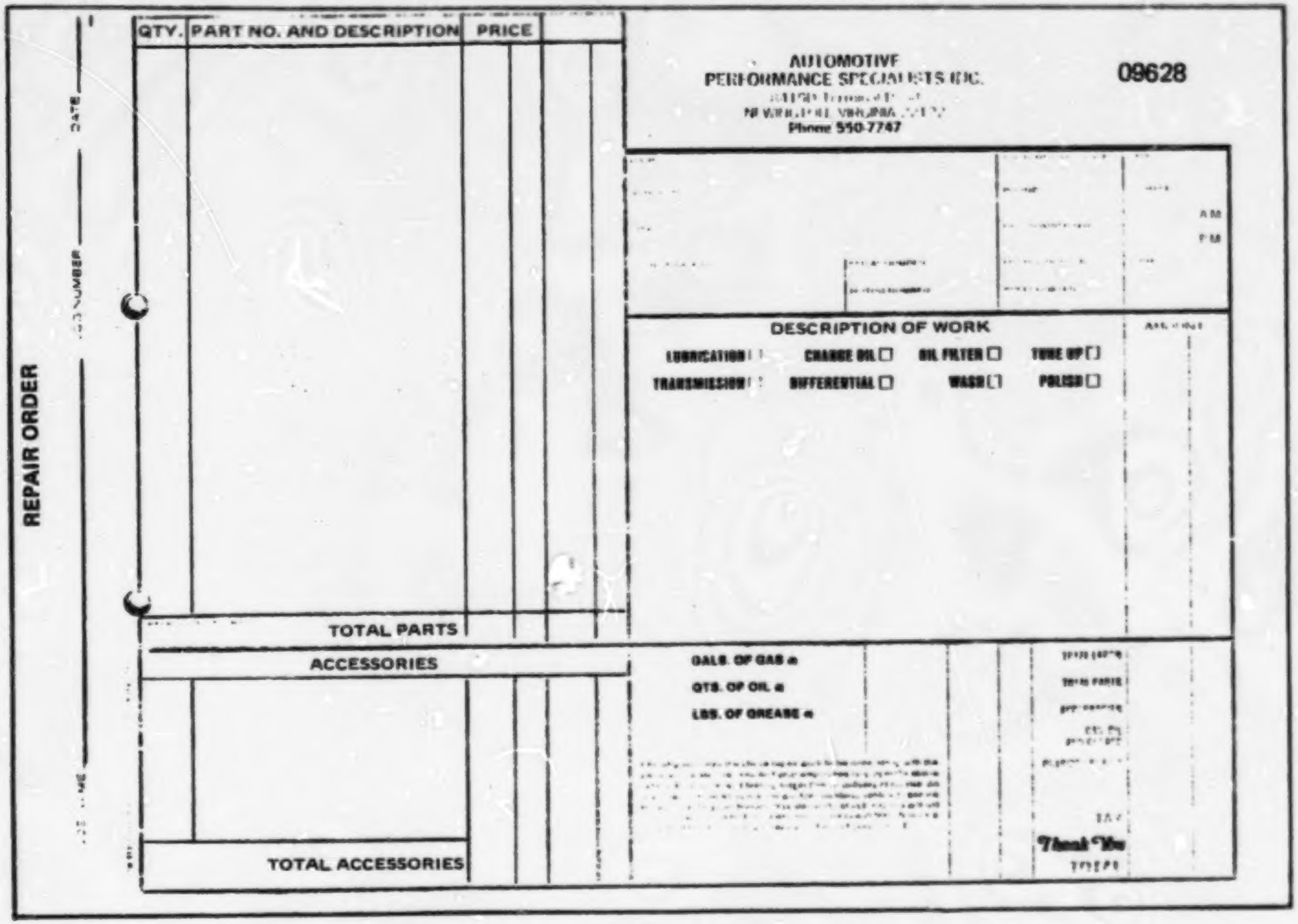

REPAIR ORDER

AUTOMOTIVE PERFORMANCE SPECIALISTS INC.

Phone 550-7747

09628

QTY.	PART NO. AND DESCRIPTION	PRICE
	TOTAL PARTS	
	ACCESSORIES	
	TOTAL ACCESSORIES	

DESCRIPTION OF WORK

LUBRICATION ☐ CHANGE OIL ☐ OIL FILTER ☐ TUNE UP ☐
TRANSMISSION ☐ DIFFERENTIAL ☐ WASH ☐ POLISH ☐

AM
PM

GALS. OF GAS @
QTS. OF OIL @
LBS. OF GREASE @

TOTAL PARTS
TAX
Thank You
TOTAL

FIGURE 3. AUTOMOTIVE PERFORMANCE SPECIALISTS REPAIR ORDER

7. Dynamometer: None.

8. Noise Testing: None.

9. Fuel Testing: None.

10. Other: (One) Snap-on Voltmeter MT-406
(One) Snap-on GMC Diagnostic Adapter MT-86
(One) Snap-on Alternator/Voltage Regulator (AVR) MT 552
(One) Marquette Battery Charger 32-140.

NOTE: Performance Analyzer, oscilloscope, and AVR were purchased in March 1979 for approximately $9,000.

11. Plans for Replacement: None. Equipment is relatively new.

12. Technical Library:

Chilton Manuals:
    Flat Rate and Parts Manual
    Truck and Van Service Manual
    Labor Guide and Parts Manual
    Import Car Repair Manual
Motor Age
Road and Track
Service Station Management.

13. Mobile Equipment: None.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: Mechanics maintain equipment as needed.

2. Frequency of Gas Calibration for Emission Analyzer: Minor calibrations (span-checks) are performed by the mechanics. Snap-on representatives are called if a mechanic doubts the calibration of the unit.

VII. FACILITY STAFFING

1. Program Director: Greg Miller (owner/mechanic).

2. Station Manager: None.

3. Master Mechanic: None.

4. Junior Mechanic:* David Brosius, Larry Fary
(2 apprentices taught by Miller).

5. Diagnosticians: None.

6. Aides: None.

7. Clerical: Betsey Dorman.

8. Other: None.

VIII. TRAINING

1. Mechanic Experience Requirements: Inspector must have mechanical aptitude. Greg Miller has 14 years of repair experience and 4 years of diagnostic experience.

2. Employee Training Provisions: Owner hires apprentices and trains them to be mechanics. They are encouraged to pass NIASE tests.

3. Technical Update Meetings: Owner keeps abreast of technological changes by utilizing the "Chek-Chart" magazine and other publications. If there are other problems, Miller contacts the service manager at a dealership for the same make car.

IX. QUALITY CONTROL

1. Supervision for Inspectors: The owner supervises the inspections.

2. Surveys of Customer Satisfaction: Georgetown University Law Center endorsement.

3. Criteria for Failure: Manufacturer's specifications and State standards are used. Vehicle components are rated adjust/repair/good.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Will reinspect vehicle after repair for quality of work.

---

* All inspections are performed by the junior mechanics.

XI. CUSTOMER INTERFACE

1. Counseling: Inspector will review checksheet with customer diagnosing problem and critical areas for 10-15 minutes. He then will write a repair order and have Greg Miller make an estimate.

2. Additional Customer Services: Customer may observe inspection in work area as long as he does not interfere with the work.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Process Time Per Vehicle:

   1 inspector: 40-42 minutes.

2. Time at Each Station in the Bay:

   Visual inspection: 2 min.
   Car jacked up: 15 min.
   Visual underhood: 3-5 min.
   Engine/emissions analysis: 15 mins.
   Road test: 5 min.

3. Theoretical Maximum Throughput: Eight vehicles/day.

4. Average Throughput: Varies from 2-3/day to none for a week.

5. Appointments Used: Yes.

6. Busiest Time of Year: Generally busy during the first and last part of the month.

7. Maximum Number of Vehicles Processed per Hour for the Entire Facility: One.

XIII. CONSUMER AND COMMUNITY RELATIONS

Owner had no information in this area.

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment:

Equipment: original cost $20,000

2. Current Average Hourly Labor Rate:

paid by customers: $25 American vehicles
$28 Foreign vehicles

DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: Avocation Ltd.
2929 J Eskridge Road
Merrifield, Virginia

2. Contact Name and Number: Gerald Brown (owner/mechanic)
(703) 573-8464

3. General Description of Facility: Avocation Ltd. is a diagnostic/repair/training facility founded, operated and owned by Gerald Brown. Mr. Brown has stated that the diagnostic section of his operation is not profitable by itself. He, nevertheless, has dedicated his time and money to designing and implementing an unbiased, complete diagnostic inspection. Mr. Brown has used and tested a variety of modern diagnostic equipment for his inspection service. The car repair service accounts for approximately 70 percent of the business income and is a direct product of the diagnostic services. Mr. Brown will only repair those vehicles Avocation has inspected. In the back of the repair area are two classrooms used to teach the five-course instructional program. Students receive practical, on-car instruction in the shop as well as in classroom instruction.

4. Vehicle Types Inspected: All foreign and American passenger vehicles, vans, motorcycles, and some trucks.

5. Types of Inspection Services: Engine/emissions diagnosis, brake diagnosis.

6. Hours of Operation: M-F 8:00 a.m. to 5:30 p.m.

7. Physical Area of Inspection Facility: Entire rented warehouse area is 5,793 sq. ft. Facility is a modified warehouse located in an industrial park.

8. Inspection Station Dimensions: 4,323 square feet.

9. Number of Bays: 6 bay areas.

10. Bay Dimensions: Open floor area.

11. Queueing Area: Not required due to appointments.

12. Parking Area: Six spaces are reserved for Avocation.

13. Facility Diagram and Location of Equipment: See Figure 1.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Remodeled: Mr. Brown remodeled and rearranged the area in 1980.

2. Construction Type and Material: Brick warehouse with concrete floor and sheet metal roof.

3. Patron Accommodations: Customer lounge.

4. Ventilation System Design: 1200 CFM centralized exhaust removal system with 70-foot rubber exhaust hoses extending from ceiling. Four free-standing fans are positioned throughout work area.

5. Safety Accommodations: The facility observes regular day-to-day safety procedures.

6. Noise Accommodations: None.

III. STEPS OF INSPECTION PROCESS

1. Check-In: Clerk (Mrs. Brown) prepares car history sheet, writes up any current problems.

2. Test Sequence: Will not divulge. Proprietary information.

3. Data Handling: Diagnostician completes checksheet. Customer receives checksheet copy and Sun 2001 printout. If repairs are performed, an estimate and a workcard detailing the amount of time to perform each task is written and put in customer's file folder. (Avocation will hold files for a 3-year period.) Typed reports of the car inspection results are available for $15.00 for commercial clients and $0-5 for other customers.

4. Check-Out: Diagnostician will review and explain diagnostic checksheet highlighting the most serious problem areas.

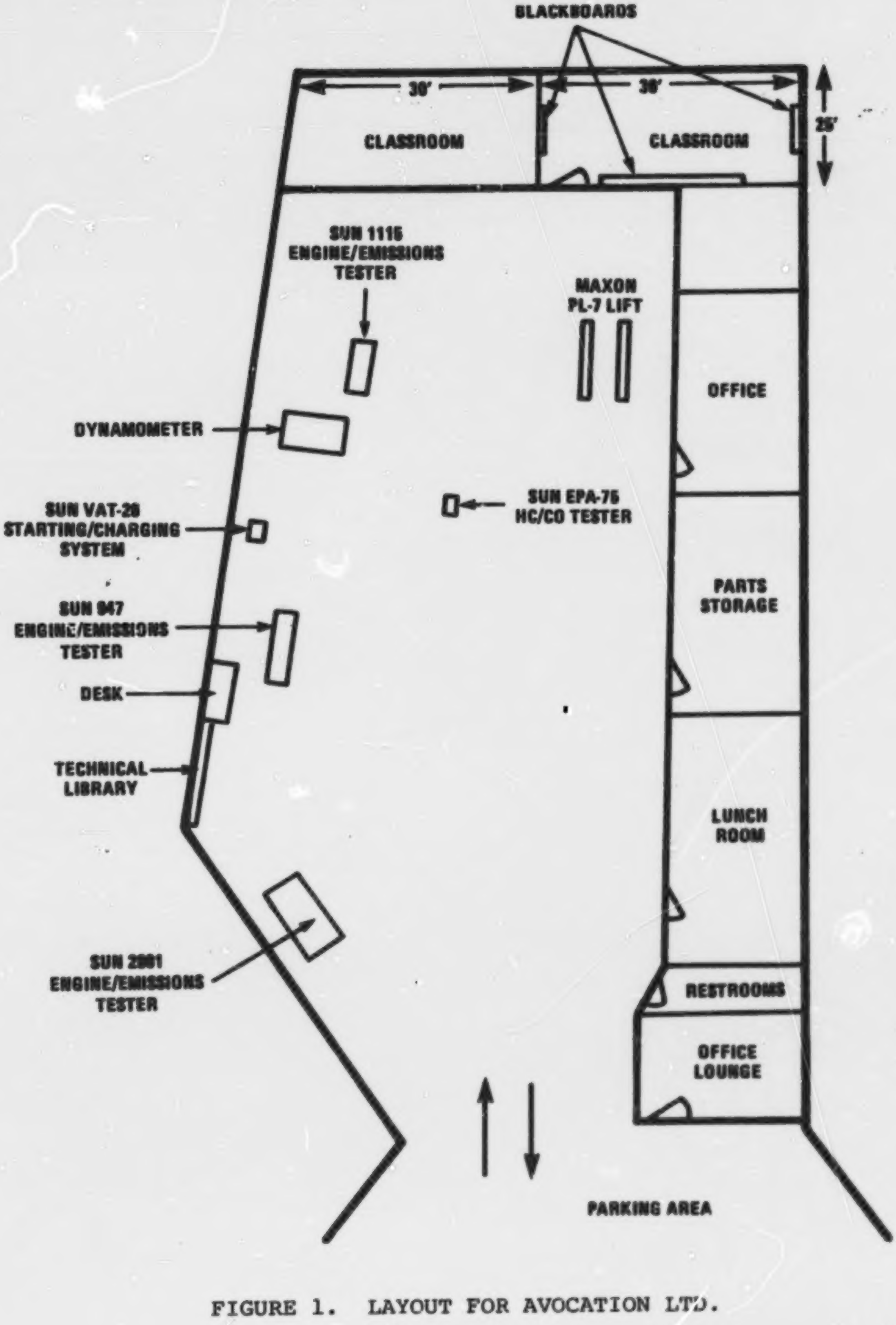
BLACKBOARDS
30'
30'
25'
CLASSROOM
CLASSROOM
SUN 1115 ENGINE/EMISSIONS TESTER
MAXON PL-7 LIFT
OFFICE
DYNAMOMETER
SUN EPA-75 HC/CO TESTER
SUN VAT-20 STARTING/CHARGING SYSTEM
PARTS STORAGE
SUN 947 ENGINE/EMISSIONS TESTER
DESK
TECHNICAL LIBRARY
LUNCH ROOM
SUN 2001 ENGINE/EMISSIONS TESTER
RESTROOMS
OFFICE LOUNGE
PARKING AREA

FIGURE 1. LAYOUT FOR AVOCATION LTD.

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5. Comments: Avocation will perform same full engine inspection process on every vehicle. Mr. Brown will not do isolated inspections of engine areas. He believes that the entire engine must be inspected in order to diagnose any problem and make the proper repairs.

IV. FEES

1. Diagnostic Inspection:

Engine Diagnosis	$28.50
Safety Check	$21.60

2. Other Services: Will write report for commercial clients for $15.00 and for private customers for $1 to $5.00.

V. TEST EQUIPMENT

1. Brakes: Micrometer. Brakes checked by wheel pull/road test.

2. Alignment: Not tested.

3. Headlight Aim: None.

4. Lift: (One) Maxon PL-7 electric above ground lift.

5. Emissions Analyzer: (One) Sun EPA-75 HC/CO Analyzer.

6. Engine Analyzer: (One) Sun 2001, (one) Sun 1115, (one) Sun 947.

7. Dynamometer: (One) Clayton (will be installed in near future).

8. Noise Testing: None.

9. Fuel Economy: None.

10. Other: Sun VAT-28 Starting/Charging System.

11. Plans for Replacement:

    - Will be installing Clayton dynamometer soon
    - Has had another computerized dynamometer ($50,000) but had it removed following a disagreement with the manufacturer.

[redacted]

- Mr. Brown is considering using Burroughs fuel metering equipment to measure fuel economy.

12. Technical Library:

Chilton's manuals
Mitchell's manuals
Motor
Extensive foreign car manuals
Some American manufacturer manuals.

13. Mobile Equipment: None.

VI. EQUIPMENT MAINTENANCE.

1. Frequency of Equipment Maintenance: Engine analyzer calibrated every 3 months.

2. Frequency of Gas Calibration for Emission Analyzer: Every 3 months.

VII. FACILITY STAFFING

1. Program Director: One (Gerald Brown).

2. Station Manager:* One Foreman (Ken Casassa).

3. Master Mechanics:* Three.

4. Junior Mechanics: One apprentice.

5. Diagnosticians (only): None.

6. Aides: None.

7. Clerical: One (Mrs. Yvonne Brown).

8. Other:

VIII. TRAINING

1. Mechanic Experience Requirements: Mr. Brown is NIASE-certified and has been in diagnostics since 1973. Other mechanics are trained on-the-job and in Brown's "Automotive Academy."

---

* All inspections are performed by either the station manager or a master mechanic.

2. Employee Training Provisions: Avocation provides an automotive training school called the "Automotive Academy." The school offers the following courses:

Course	Hours	Cost
Automotive Testing and Diagnosis	32	$155.00
Emissions Control Operation & Service	18	124.30
Basic Electrical	18	123.50
Oscilliscope Analysis	12	97.00
Air Conditioning	24	147.50

The "Automotive Testing and Diagnosis" course is comprised of 6 parts: compression, ignition, fuel, emission control, starting and charging systems. Course curriculum includes practical, hands-on experience, as well as in-class studies. Students take written examinations to test knowledge. Students receive a diploma for maintaining a "C" average (71 percent) throughout the course.

3. Technical Update Meetings: Owner and staff keep up to date by reading the latest periodicals and manuals on automotive technology.

IX. QUALITY CONTROL

1. Supervision for Inspectors: Mr. Brown will respond to any questions or problems that may arise.

2. Surveys of Customer Satisfaction: None.

3. Criteria for Failure: Avocation uses Chilton manuals and manufacturer specifications to determine pass/fail condition.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Usually will not charge for reinspection after repair by another shop.

XI. CUSTOMER INTERFACE

1. Counseling: The station manager or a master mechanic will counsel client, explain problem, and provide estimate for repairs (if requested).

2. Additional Customer Services: Avocation will provide a list of items to be repaired and a corresponding estimate. If owner elects not to have Avocation perform repairs, Avocation will make recommendations as to the type of repair facility (not any one specific facility) to best have repairs performed.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: One hour 15 minutes (One inspector.)

2. Time at Each Station in the Lane: Not available.

3. Theoretical Maximum Throughput: Eight vehicles per day. (Two inspectors.)

4. Average Throughput: Four per day.

5. Appointments Used: Yes.

6. Busiest Time of Year: Spring and fall.

7. Maximum Number of Vehicles Processed per Hour for the Entire Facility: One.

XIII. CONSUMER AND COMMUNITY RELATIONS

No special relations.

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment: $37,000.

2. Current Average Hourly Labor Rate: Mechanics with less than 3 years experience are paid $300/week.

DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: Call Carl
30 L Street, S.W.
Washington, D.C. 20024

2. Contact Name and Number: Rich Little (Diagnostic Technician)
(202) 554-3404

3. General Description of Facility: Call Carl operates 13 repair/service stations in the Washington, D.C./Virginia/Maryland area. The 30 L Street, S.W. station is the only station to operate a diagnostic lane. This station also is the only station that does not pump gas. Adjacent to the repair/diagnostic lane is the Call Carl main office.

4. Vehicle Types Inspected: All American passenger vehicles. No foreign cars. No diesels. No vans, trucks, motorcycles.

5. Types of Inspection Services: Brake diagnosis, engine diagnosis, vehicle diagnosis (150 items).

6. Hours of Operation: M-F 9:00 a.m. to 4:00 p.m.

7. Physical Area of Inspection Facility: Inspection lane is 18' wide by 75' long in a building that houses a 4-bay repair area and the Call Carl main office.

8. Inspection Station Dimensions: 18' x 75' inspection lane.

9. Number of Lanes: One lane. Four service bays for repairs.

10. Lane Dimensions: 18' x 75' (estimated).

11. Queueing Area: Not required due to appointment system.

12. Parking Area: Parking lot located across street.

13. Facility Diagram and Location of Equipment: See Figure 1.

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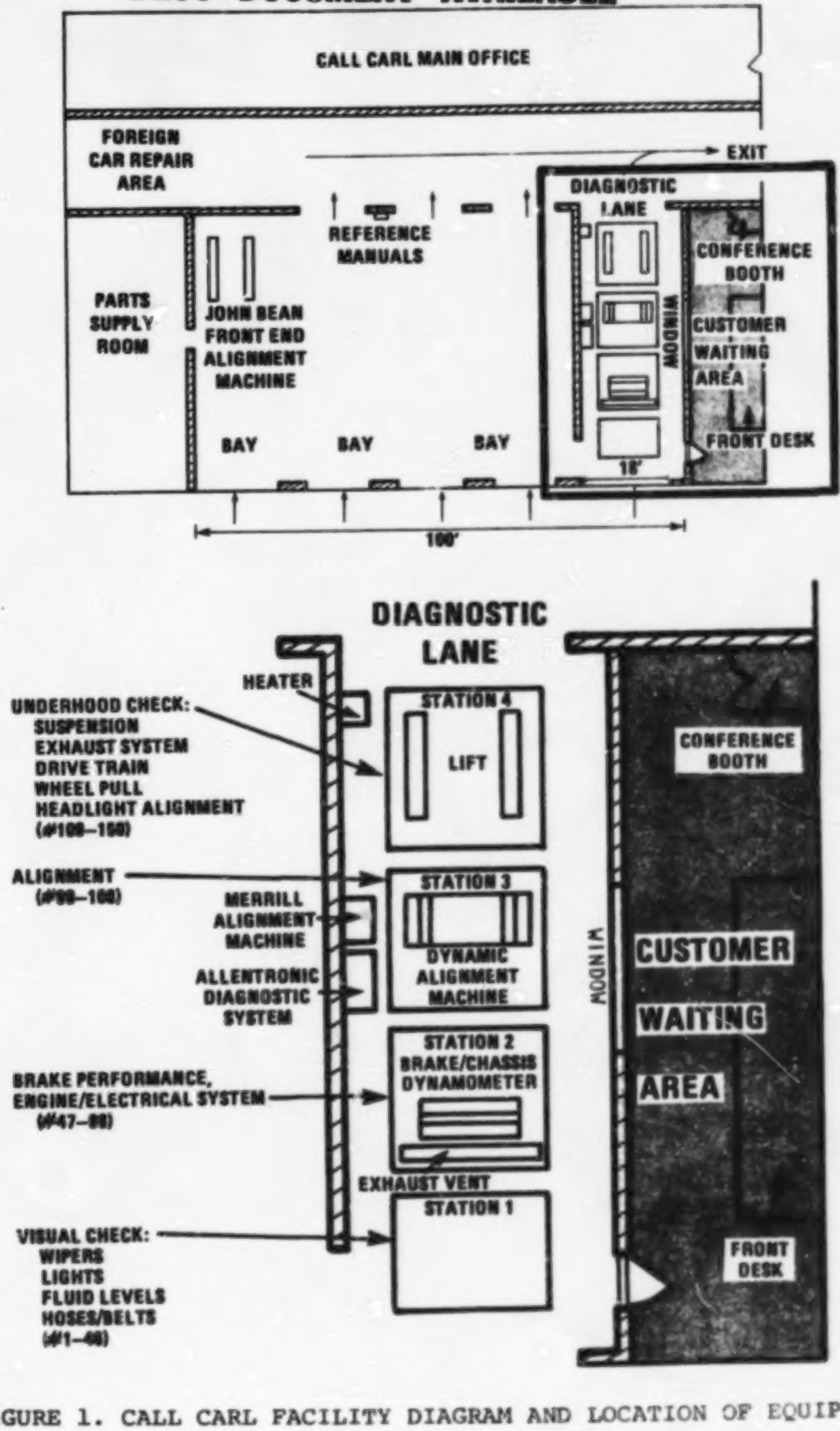
CALL CARL MAIN OFFICE
FOREIGN CAR REPAIR AREA
EXIT
DIAGNOSTIC LANE
REFERENCE MANUALS
CONFERENCE BOOTH
PARTS SUPPLY ROOM
JOHN BEAN FRONT END ALIGNMENT MACHINE
WINDOW
CUSTOMER WAITING AREA
BAY
BAY
BAY
FRONT DESK
18'
100'
DIAGNOSTIC LANE
HEATER
UNDERHOOD CHECK:
SUSPENSION
EXHAUST SYSTEM
DRIVE TRAIN
WHEEL PULL
HEADLIGHT ALIGNMENT
(#109–150)
STATION 4
LIFT
CONFERENCE BOOTH
ALIGNMENT
(#89–108)
STATION 3
MERRILL ALIGNMENT MACHINE
DYNAMIC ALIGNMENT MACHINE
ALLENTRONIC DIAGNOSTIC SYSTEM
WINDOW
CUSTOMER
WAITING
AREA
BRAKE PERFORMANCE,
ENGINE/ELECTRICAL SYSTEM
(#47–88)
STATION 2
BRAKE/CHASSIS DYNAMOMETER
EXHAUST VENT
STATION 1
VISUAL CHECK:
WIPERS
LIGHTS
FLUID LEVELS
HOSES/BELTS
(#1–46)
FRONT DESK

FIGURE 1. CALL CARL FACILITY DIAGRAM AND LOCATION OF EQUIPMENT

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: The diagnostic lane was constructed 15 years ago (1965) by building a wall on one side of a repair bay.

2. Construction Style and Material: Brick and concrete rectangular building with terra cotta facade on upper portion (2-story building).

3. Patron Accommodations in Addition to Lanes: Glass-enclosed customer waiting area. Conference booth for post-inspection discussion.

4. Ventilation System Design: Eight-foot-long louvered vent over exhaust pit which leads to exhaust ventilation system. Large free-standing fan at end of lane.

5. Safety Accommodations: None. Customers not allowed in lane during testing.

6. Noise Accommodations: Glass-enclosed waiting area. No special sound proofing. Noise levels are highest in the lane and lowest in the waiting area.

III. STEPS OF INSPECTION PROCESS

1. Check-In: Discussion with diagnostician in waiting room. Diagnostician fills in top part of report form. (See Figure 2.)

2. Test Sequence: (See Figure 2 for item breakdown).

   - Visual checks - tires, lights, belts, cooling system, exterior, interior, underhood items (Items 1-46).
   - Dynamic brake test - check balance, transmission, speedometer, horsepower (Items 47-55)
   - Engine analysis - check alternator, spark plugs, points, condenser, carburetor, overall engine condition, dwell and tachometer (Items 56-98)
   - Front end alignment (Items 99-108)
   - Vehicle on lift - check suspension, exhaust system, headlights, alignment, pull front axle wheel (Items 109-150)

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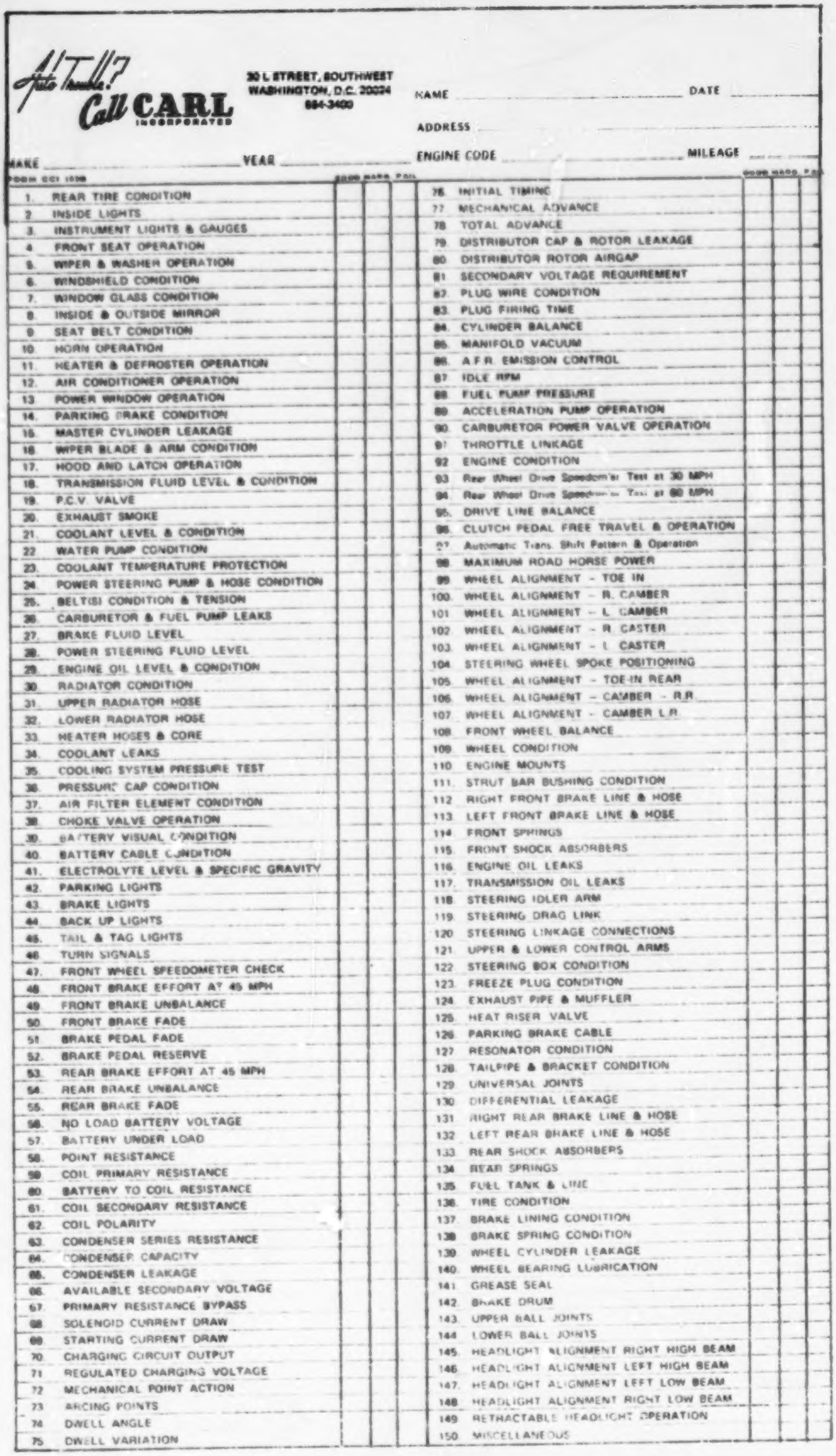

Auto Trouble? Call CARL INCORPORATED

30 L STREET, SOUTHWEST
WASHINGTON, D.C. 20024
554-3400

NAME ______________________ DATE __________

ADDRESS ______________________

MAKE ______________ YEAR ______________ ENGINE CODE ______________ MILEAGE ______

FORM CCI [illegible]

		GOOD	MARG	FAIL
1.	REAR TIRE CONDITION			
2	INSIDE LIGHTS			
3.	INSTRUMENT LIGHTS & GAUGES			
4	FRONT SEAT OPERATION			
5.	WIPER & WASHER OPERATION			
6.	WINDSHIELD CONDITION			
7.	WINDOW GLASS CONDITION			
8.	INSIDE & OUTSIDE MIRROR			
9	SEAT BELT CONDITION			
10	HORN OPERATION			
11.	HEATER & DEFROSTER OPERATION			
12.	AIR CONDITIONER OPERATION			
13	POWER WINDOW OPERATION			
14.	PARKING BRAKE CONDITION			
15.	MASTER CYLINDER LEAKAGE			
16.	WIPER BLADE & ARM CONDITION			
17.	HOOD AND LATCH OPERATION			
18.	TRANSMISSION FLUID LEVEL & CONDITION			
19.	P.C.V. VALVE			
20.	EXHAUST SMOKE			
21.	COOLANT LEVEL & CONDITION			
22	WATER PUMP CONDITION			
23.	COOLANT TEMPERATURE PROTECTION			
24.	POWER STEERING PUMP & HOSE CONDITION			
25.	BELT(S) CONDITION & TENSION			
26.	CARBURETOR & FUEL PUMP LEAKS			
27.	BRAKE FLUID LEVEL			
28.	POWER STEERING FLUID LEVEL			
29.	ENGINE OIL LEVEL & CONDITION			
30.	RADIATOR CONDITION			
31.	UPPER RADIATOR HOSE			
32.	LOWER RADIATOR HOSE			
33.	HEATER HOSES & CORE			
34.	COOLANT LEAKS			
35.	COOLING SYSTEM PRESSURE TEST			
36.	PRESSURE CAP CONDITION			
37.	AIR FILTER ELEMENT CONDITION			
38.	CHOKE VALVE OPERATION			
39.	BATTERY VISUAL CONDITION			
40.	BATTERY CABLE CONDITION			
41.	ELECTROLYTE LEVEL & SPECIFIC GRAVITY			
42.	PARKING LIGHTS			
43.	BRAKE LIGHTS			
44.	BACK UP LIGHTS			
45.	TAIL & TAG LIGHTS			
46.	TURN SIGNALS			
47.	FRONT WHEEL SPEEDOMETER CHECK			
48.	FRONT BRAKE EFFORT AT 45 MPH			
49.	FRONT BRAKE UNBALANCE			
50.	FRONT BRAKE FADE			
51.	BRAKE PEDAL FADE			
52.	BRAKE PEDAL RESERVE			
53.	REAR BRAKE EFFORT AT 45 MPH			
54.	REAR BRAKE UNBALANCE			
55.	REAR BRAKE FADE			
56.	NO LOAD BATTERY VOLTAGE			
57.	BATTERY UNDER LOAD			
58.	POINT RESISTANCE			
59.	COIL PRIMARY RESISTANCE			
60.	BATTERY TO COIL RESISTANCE			
61.	COIL SECONDARY RESISTANCE			
62.	COIL POLARITY			
63.	CONDENSER SERIES RESISTANCE			
64.	CONDENSER CAPACITY			
65.	CONDENSER LEAKAGE			
66.	AVAILABLE SECONDARY VOLTAGE			
67.	PRIMARY RESISTANCE BYPASS			
68	SOLENOID CURRENT DRAW			
69	STARTING CURRENT DRAW			
70	CHARGING CIRCUIT OUTPUT			
71	REGULATED CHARGING VOLTAGE			
72	MECHANICAL POINT ACTION			
73	ARCING POINTS			
74	DWELL ANGLE			
75	DWELL VARIATION			

		GOOD	MARG	FAIL
76.	INITIAL TIMING			
77.	MECHANICAL ADVANCE			
78	TOTAL ADVANCE			
79.	DISTRIBUTOR CAP & ROTOR LEAKAGE			
80	DISTRIBUTOR ROTOR AIRGAP			
81	SECONDARY VOLTAGE REQUIREMENT			
82.	PLUG WIRE CONDITION			
83.	PLUG FIRING TIME			
84.	CYLINDER BALANCE			
85.	MANIFOLD VACUUM			
86.	A.F.R. EMISSION CONTROL			
87	IDLE RPM			
88	FUEL PUMP PRESSURE			
89	ACCELERATION PUMP OPERATION			
90.	CARBURETOR POWER VALVE OPERATION			
91	THROTTLE LINKAGE			
92	ENGINE CONDITION			
93	Rear Wheel Drive Speedom'tr Test at 30 MPH			
94.	Rear Wheel Drive Speedom'tr Test at 60 MPH			
95.	DRIVE LINE BALANCE			
96.	CLUTCH PEDAL FREE TRAVEL & OPERATION			
97.	Automatic Trans. Shift Pattern & Operation			
98.	MAXIMUM ROAD HORSE POWER			
99	WHEEL ALIGNMENT - TOE IN			
100.	WHEEL ALIGNMENT - R. CAMBER			
101	WHEEL ALIGNMENT - L. CAMBER			
102	WHEEL ALIGNMENT - R. CASTER			
103.	WHEEL ALIGNMENT - L. CASTER			
104	STEERING WHEEL SPOKE POSITIONING			
105.	WHEEL ALIGNMENT - TOE-IN REAR			
106.	WHEEL ALIGNMENT - CAMBER - R.R.			
107.	WHEEL ALIGNMENT - CAMBER L.R.			
108.	FRONT WHEEL BALANCE			
109.	WHEEL CONDITION			
110	ENGINE MOUNTS			
111.	STRUT BAR BUSHING CONDITION			
112	RIGHT FRONT BRAKE LINE & HOSE			
113.	LEFT FRONT BRAKE LINE & HOSE			
114	FRONT SPRINGS			
115.	FRONT SHOCK ABSORBERS			
116.	ENGINE OIL LEAKS			
117.	TRANSMISSION OIL LEAKS			
118.	STEERING IDLER ARM			
119.	STEERING DRAG LINK			
120	STEERING LINKAGE CONNECTIONS			
121.	UPPER & LOWER CONTROL ARMS			
122	STEERING BOX CONDITION			
123.	FREEZE PLUG CONDITION			
124	EXHAUST PIPE & MUFFLER			
125.	HEAT RISER VALVE			
126	PARKING BRAKE CABLE			
127	RESONATOR CONDITION			
128.	TAILPIPE & BRACKET CONDITION			
129	UNIVERSAL JOINTS			
130	DIFFERENTIAL LEAKAGE			
131	RIGHT REAR BRAKE LINE & HOSE			
132	LEFT REAR BRAKE LINE & HOSE			
133	REAR SHOCK ABSORBERS			
134	REAR SPRINGS			
135	FUEL TANK & LINE			
136.	TIRE CONDITION			
137.	BRAKE LINING CONDITION			
138	BRAKE SPRING CONDITION			
139	WHEEL CYLINDER LEAKAGE			
140.	WHEEL BEARING LUBRICATION			
141	GREASE SEAL			
142.	BRAKE DRUM			
143.	UPPER BALL JOINTS			
144	LOWER BALL JOINTS			
145.	HEADLIGHT ALIGNMENT RIGHT HIGH BEAM			
146	HEADLIGHT ALIGNMENT LEFT HIGH BEAM			
147.	HEADLIGHT ALIGNMENT LEFT LOW BEAM			
148	HEADLIGHT ALIGNMENT RIGHT LOW BEAM			
149	RETRACTABLE HEADLIGHT OPERATION			
150.	MISCELLANEOUS			

FIGURE 2. CALL CARL DIAGNOSTIC REPORT

3. Data Handling: Teletype data recording transfer of inspection results and progress from the lane to the waiting room. Diagnostician uses same manual check-sheet as sheet printed on teletype.

4. Check-Out: Diagnostician will explain inspection sheet to customer and provide a Call Carl estimate for most important repairs.

IV. FEES

1. Diagnostic Inspection: Complete diagnosis - $21.95
   Engine analysis - $16.95
   Speedometer check - $8.00

2. Other Services: All 13 Call Carl Centers offer complete repair services, including transmissions and body work. Repairs are available in a separate area. Approximately 60-75 percent of diagnostic customers have repairs performed by Call Carl.

V. TEST EQUIPMENT

1. Brakes: Clayton Brake/Chassis Dynamometer B8 CP 200.

2. Alignment: Merrill Automatic Electric.

3. Headlight Aim: None.

4. Lift: Weaver double-post.

5. Emission Analyzer: None.

6. Engine Analyzer: "Allen-tronic Diagnostic System II" Model number 18-010 (cost $5,000).

7. Dynamometer: Clayton. (See Brakes.)

8. Noise Testing: None.

9. Fuel Economy: No special equipment.

[redacted]

10. Other: Rontel computer and printer (Cost $4,000).

11. Plans for Replacement: Will be replacing Merrill alignment with scuff gauge in near future, because the Merrill alignment was prone to breakdown.

12. Technical Library:

    Chilton manual
    Mitchell manuals
    Motor Magazine
    Siemens Test Guide

13. Mobile Equipment: None.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Maintenance: Dynamometer and alignment machine maintained monthly. Clayton representative calibrates machinery 1-2 times per year.

2. Frequency of Gas Calibration for Emission Analyzer: Not applicable.

VII. FACILITY STAFFING

1. Program Director: Conrad Murer.

2. Station Manager: One.

3. Master Mechanics: Varies from 9 to 11.

4. Junior Mechanics: None.

5. Diagnosticians: One (Rich Little).

6. Aides: None.

7. Clerical: One receptionist.

8. Other: None.

VIII. TRAINING

1. Inspector Experience Requirements: Must be a mechanic or diagnostician. The present diagnostician has 8 years of experience with Call Carl.

[redacted]

2. Employee Training Provisions: None.

3. Technical Update Meetings: None.

IX. QUALITY CONTROL

1. Supervision for Inspectors: The diagnostician confers with the service manager if any problems develop.

2. Surveys of Customer Satisfaction: A study conducted by AAA revealed no complaints.

3. Criteria for Failure (Standards): Vehicles are checked against the manufacturer's specifications or Chilton manual specifications and the local government inspection standards. Items are marked Good/Marginal/Fail.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Will inspect vehicle free if work is done at Call Carl. $4.00 reinspection charge if work is done elsewhere.

XI. CUSTOMER INTERFACE

1. Counseling: Diagnostician explains the report to customer, discusses critical areas and provides a written estimate of repairs. (See Figure 3).

2. Additional Services: Test results automatically printed in waiting room on the Rontel printer.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: 37-59 minutes.

2. Time at Each Station in the Lane:

   - Station 1, 10-17 minutes for visual checks
   - Station 2, 15-20 minutes for brakes and engine
   - Station 3, 2 minutes for alignment check
   - Station 4, 10-20 minutes for underbody check

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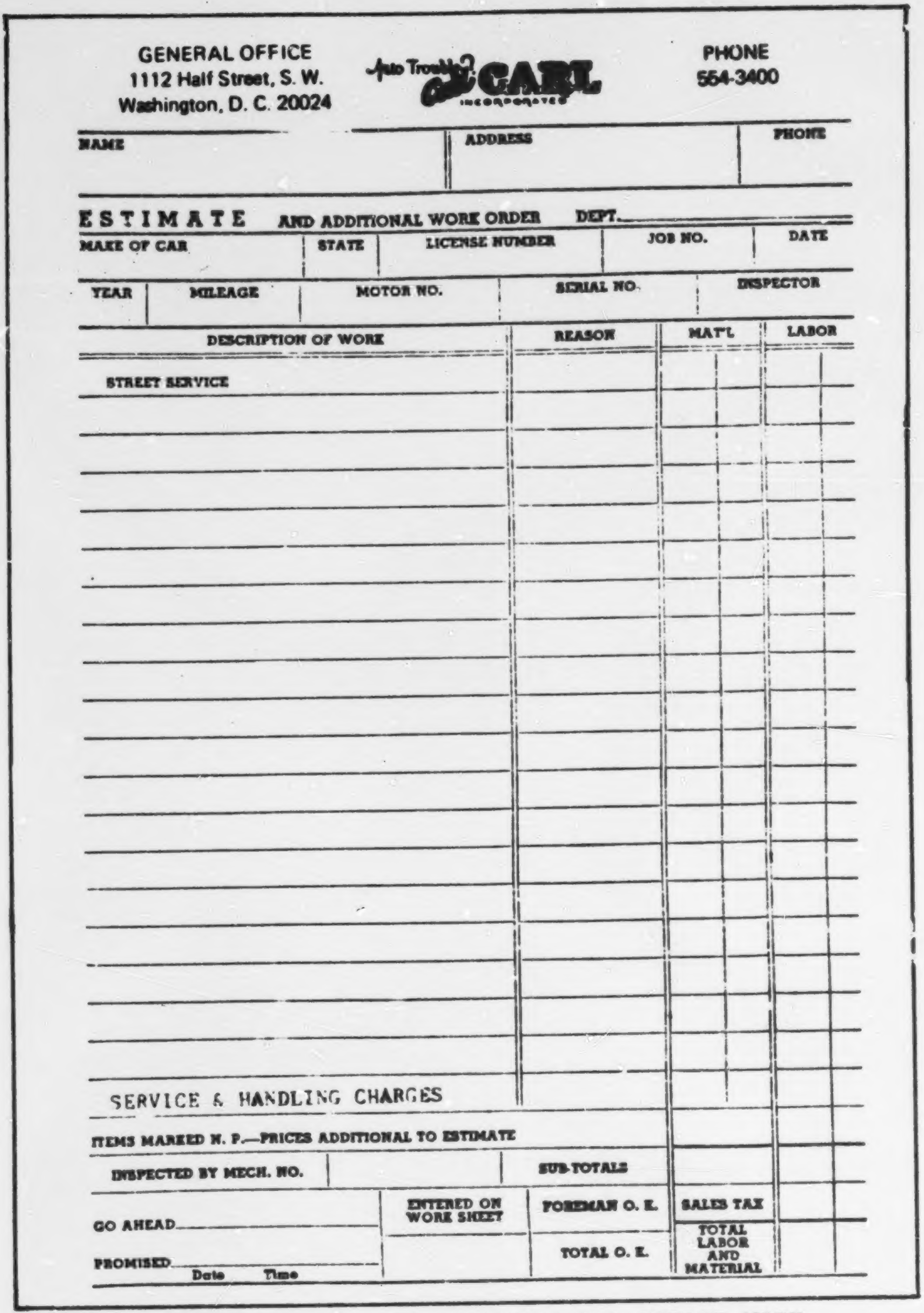

GENERAL OFFICE
1112 Half Street, S. W.
Washington, D. C. 20024

Auto Trouble? Call CARL
INCORPORATED

PHONE
554-3400

NAME	ADDRESS	PHONE

ESTIMATE AND ADDITIONAL WORK ORDER DEPT.

MAKE OF CAR	STATE	LICENSE NUMBER	JOB NO.	DATE

YEAR	MILEAGE	MOTOR NO.	SERIAL NO.	INSPECTOR

DESCRIPTION OF WORK	REASON	MAT'L	LABOR
STREET SERVICE			
SERVICE & HANDLING CHARGES			

ITEMS MARKED N. P.—PRICES ADDITIONAL TO ESTIMATE

INSPECTED BY MECH. NO. SUB-TOTALS

GO AHEAD ENTERED ON WORK SHEET FOREMAN O. K. SALES TAX

PROMISED Date Time TOTAL O. K. TOTAL LABOR AND MATERIAL

FIGURE 3. CALL CARL ESTIMATE FOR REPAIR WORK

[redacted]

- Total, 37-59 minutes

3. Theoretical Maximum Lane Throughput: 10-12 cars per day.

4. Average Lane Throughput: Eight cars per day.

5. Appointments Used: Yes.

6. Busiest Time of Year: Summer.

7. Maximum Number of Vehicles Processed Per Hour for the Entire Facility: One.

XIII. CONSUMER AND COMMUNITY RELATIONS

Better Business Bureau
National Automotive Dealer Association
Chamber of Commerce
Greater Washington Board of Trade.

XIV. INVESTMENT AND OPERATING COSTS

Current Average Hourly Labor Rate: $20.00 per hour. Customer pays this rate and mechanic makes 50 percent of the hourly rate.

[redacted]

COMMERCIAL DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: CARDOC
5300 Jackson Drive
La Mesa, California

2. Contact Name and Number: Donald H. Dechant (Owner)
3129 Brementon Place
La Jolla, California 92037
(714) 453-0247

3. General Description of Facility: Dechant operated a diagnostic lane and repair facility from February 1966 until February 1975.

4. Vehicle Types Inspected: Domestic and foreign cars and trucks to 8,000 GVW for a complete diagnostic. Larger vehicles and motor homes for an engine analysis. (Dynamometer and scope tests).

5. Types of Inspection Services: Diagnostic inspection services included a complete diagnosis, an engine analysis, (engine, ignition and carburetion) and brake balance tests. Repairs were also performed.

6. Hours of Operation: 8:00 a.m. to 5:00 p.m. Monday through Saturday.

7. Physical Area of Inspection Facility: The total area included the diagnostic lane, 16 repair bays and a reception area. The building measured 80' x 120' and was on a 1.1 acre lot.

8. Inspection Station Dimensions: Diagnostic lane 21' x 72'. Customer area and office 24' x 80'.

9. Number of Lanes: One diagnostic lane.

10. Lane Dimensions: 21' x 72'. Doors 10' high.

11. Queueing Area: Not required, as inspections were performed on an appointment basis.

12. Parking Area: The parking area accommodated 44 cars.

13. Facility Diagram and Location of Equipment: See Figure 1.

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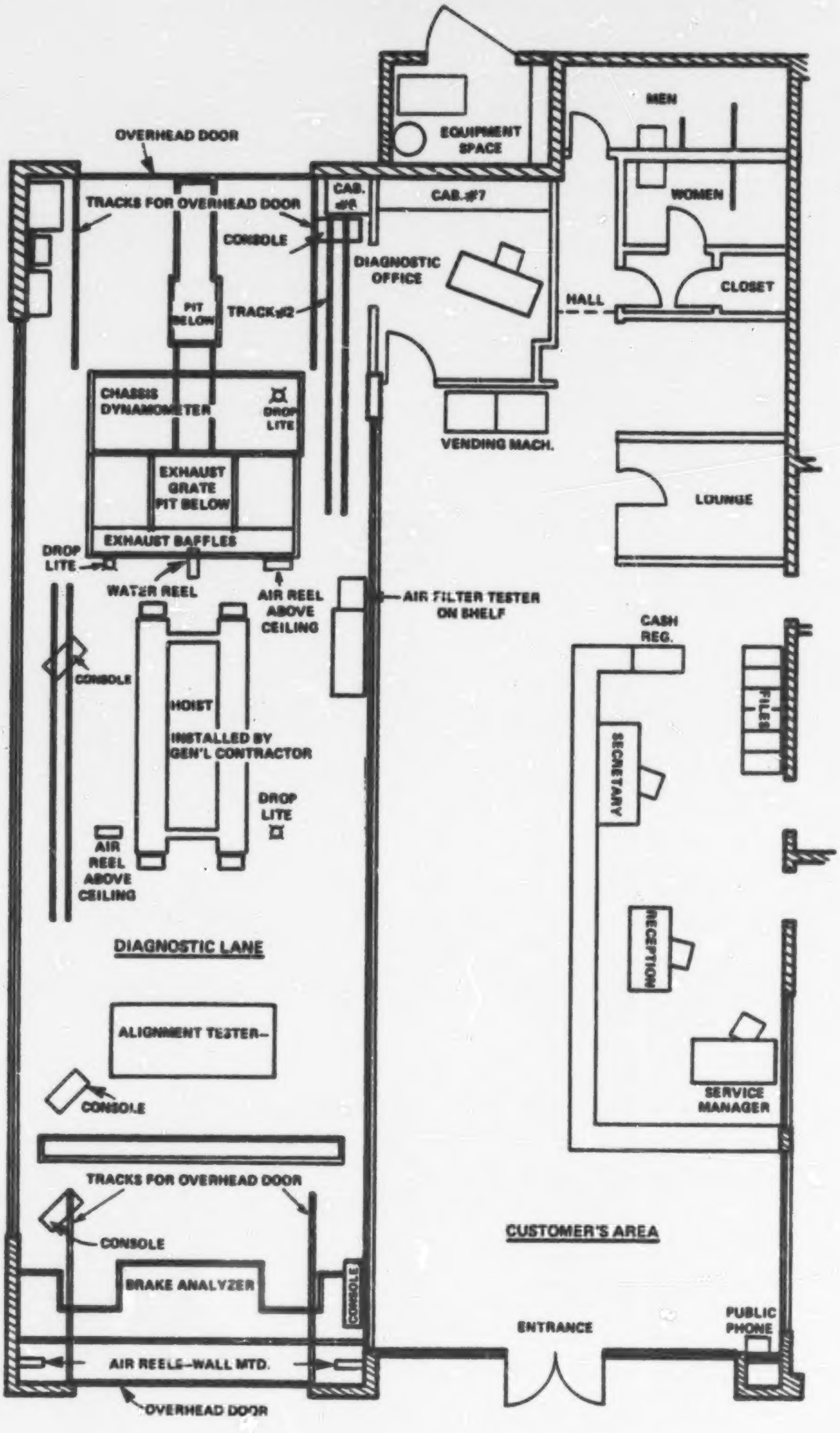
OVERHEAD DOOR
EQUIPMENT SPACE
MEN
WOMEN
CLOSET
HALL
TRACKS FOR OVERHEAD DOOR
CAB. #8
CAB. #7
CONSOLE
DIAGNOSTIC OFFICE
PIT BELOW
TRACK #2
CHASSIS DYNAMOMETER
DROP LITE
VENDING MACH.
LOUNGE
EXHAUST GRATE PIT BELOW
EXHAUST BAFFLES
DROP LITE
WATER REEL
AIR REEL ABOVE CEILING
AIR FILTER TESTER ON SHELF
CASH REG.
CONSOLE
HOIST
INSTALLED BY GEN'L CONTRACTOR
FILES
SECRETARY
DROP LITE
AIR REEL ABOVE CEILING
RECEPTION
DIAGNOSTIC LANE
ALIGNMENT TESTER
CONSOLE
SERVICE MANAGER
TRACKS FOR OVERHEAD DOOR
CONSOLE
CUSTOMER'S AREA
BRAKE ANALYZER
CONSOLE
ENTRANCE
PUBLIC PHONE
AIR REELS—WALL MTD.
OVERHEAD DOOR

FIGURE 1. CARDOC FACILITY AND LOCATION OF EQUIPMENT

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: 1965/66.

2. Construction Type and Material: The building was of cement block construction with decorative block used at lane offices and regular block at repair section. It had a Berkeley (i.e., prefabricated) roof system.

3. Patron Accommodations in Addition to Lanes: The facility featured a glass-enclosed viewing area and a conference room for consultation. Early in the program customers were invited to follow their cars through the inspection and were even allowed into the lane to view particular problems with their car. This practice was discontinued when the insurance carrier objected.

4. Ventilation System Design: A large exhaust fan forced emissions into a steel grate behind the dynamometer and a smaller grate under the vehicle engine area. The larger grate was equipped with lift-doors to direct exhaust flow down into the grate.

5. Safety Accommodations: Fire extinguisher, warning signs, floor marking of danger zones, ear protection, safety glasses, bow ties, safety in operating procedures.

6. Noise Accommodations: Glass-enclosed viewing area.

III. STEPS IN INSPECTION PROCESS

1. Check-In: Vehicle identification and symptoms collected by receptionist.

2. Test Sequence: The inspection sequence is described in Figure 2 and included the following:

   - Shock absorber test
   - Dynamic brake test and headlight alignment check
   - Dynamic wheel alignment check for caster, camber and toe
   - Wheel balance test, U-joint test, wheel balancing test

[redacted]

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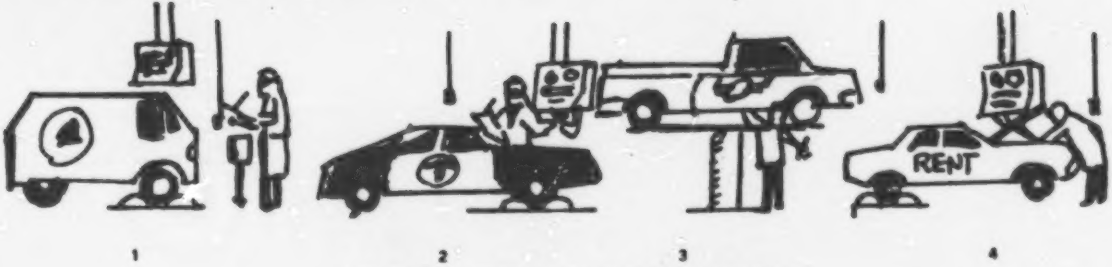
PROBLEMS FOUND



IN THE DIAGNOSTIC LANE

Station 1
BRAKES AND HEADLIGHTS

Here a dynamic brake analyzer, a specialized dynamometer, checks brakes under actual road driving conditions. Tests show braking power of each wheel, total braking effort, and degree of difference in braking action between two wheels as well as instantaneous braking balance. This detects vehicle "swerve" tendencies at high speed panic stops. Also at this "safety" station headlights are tested for aim and candlepower brightness.

Station 2
WHEEL ALIGNMENT

A computerized dynamic aligner measures true wheel alignment under actual highway conditions taking into account dynamic loads created by rolling resistance and bearing drag. The aligner takes three data points and supplies this information to a computer which then calculates Camber, Caster, and Toe angles of the suspension and steering. Readings are then compared with manufacturers' specified values. Wrong settings affect a vehicle's handling, hence safety. Out-of-line steering ruins tires and causes increased gasoline consumption.

Station 3
DIAGNOSTIC HOIST

This specialized hoist enables CARDOC to conduct complete under-hood and under-car inspections of all electrical and mechanical systems. Under-hood checks are made on the entire electrical system: battery and starter, generator or alternator, voltage regulator, starting systems, and circuitry. Also inspected are all belts, oil and coolant levels, hoses, horn, windshield wipers, and parking brakes. Automatic transmission fluid is analyzed for acid and oxidation level. Here small troubles are spotted before they become costly failures. The under-car examination includes drive line bearings and gears, suspension components, steering linkage, and exhaust systems. Steering ball joint looseness is measured, and tire wear patterns are observed. A front wheel and brake drum are removed for detailed inspection of lining thickness, other brake components, and wheel bearings. Front wheel balance is checked; depth of remaining tire tread is measured.

Station 4
ENGINE AND TRANSMISSION

Here CARDOC positions the car's rear wheels on a heavy duty chassis dynamometer and wires the engine into a console housing an ignition analyzer, volt-amp tester, spark-advance unit, and exhaust analyzer. The dynamometer rollers let the engine run under varying speeds while tests are conducted on transmission, carburetion, ignition, and fuel systems. The dyno can simulate a steep grade and make the engine work as if pulling a load uphill. Speeds where troubles occur can be held long enough to diagnose the cause. A large oscilloscope screen shows each cylinder's ignition pattern which is read to determine spark plug performance and the condition of distributor points, condenser, cam, and rotor. Meters show the relationship between the engine rpm and actual wheel speed; this pinpoints accuracy of shift points as well as nature of shift itself. During the engine analysis, exhaust gases are sampled and analyzed over the full range of operating conditions to determine carburetor efficiency.

FIGURE 2
SEQUENCE OF DIAGNOSTIC INSPECTION ACTIVITIES

- Car on lift. Check under-hood and under-car condition including electrical and mechanical condition, battery and starter, belts, fluid levels, suspension, linkage, exhaust. Pull front wheel to check the brakes, check front wheel balance.

- Engine, transmission and exhaust analysis on a chassis dynamometer.

3. Data Handling: The CARDOC manual checksheet is illustrated in Figure 3.

4. Check-Out: The diagnostician explained the checksheet and provided an estimate of repair costs.

IV. FEES

1. Diagnostic Inspection: $6.95 (in 1966) to $12.95 (in 1975).

2. Other Services: Complete repair services.

V. TEST EQUIPMENT

Equipment for the diagnostic lane and the repair bays included:

1. Brakes: Clayton dynamic brake tester.

2. Alignment: Merrill Alignment Tester.

3. Headlight Aim: Weaver.

4. Lift: (Five) Lincoln single-post hoists
   (One) Weaver two-post hoist
   (One) Globe drive-on hoist in lane.

5. Emission Analyzer: Beckman.

6. Engine Analyzer: (Two) Sun Electronic Engine Analyzers
   (One) Clayton CSJ7100

7. Dynamometer: (Three) Clayton 200 horsepower chassis dynamometers.

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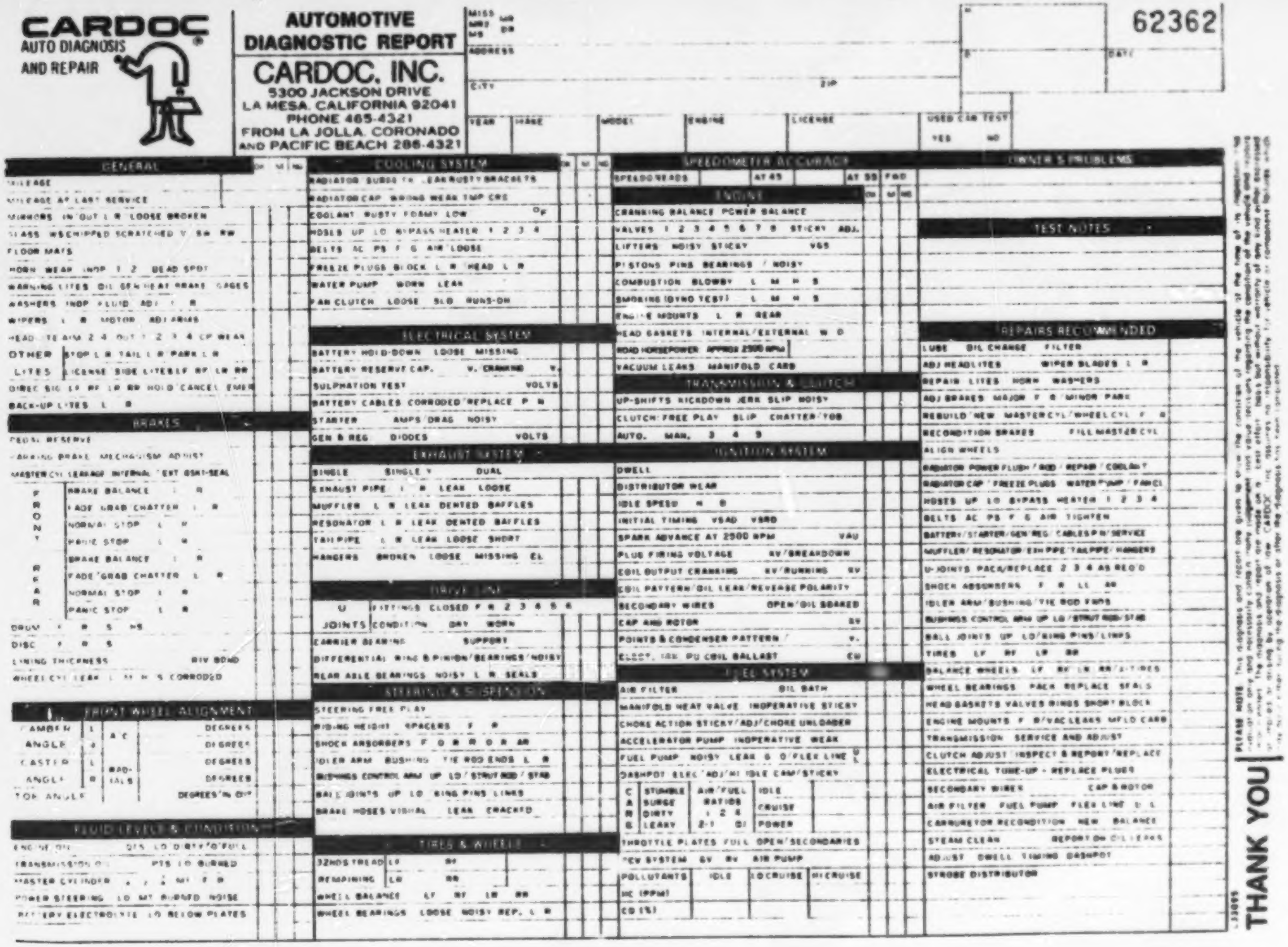

CARDOC
AUTO DIAGNOSIS
AND REPAIR

AUTOMOTIVE DIAGNOSTIC REPORT

CARDOC, INC.
5300 JACKSON DRIVE
LA MESA, CALIFORNIA 92041
PHONE 465-4321
FROM LA JOLLA, CORONADO
AND PACIFIC BEACH 286-4321

MISS MR
MRS DR
MS

ADDRESS

CITY ZIP

62362

DATE

YEAR	MAKE	MODEL	ENGINE	LICENSE	USED CAR TEST YES NO

GENERAL OK M NG

MILEAGE
MILEAGE AT LAST SERVICE
MIRRORS IN OUT L R LOOSE BROKEN
GLASS WS CHIPPED SCRATCHED V SW RW
FLOOR MATS
HORN WEAK INOP 1 2 DEAD SPOT
WARNING LITES OIL GEN HEAT BRAKE GAGES
WASHERS INOP FLUID ADJ L R
WIPERS L R MOTOR ADJ ARMS
HEAD LITE AIM 2 4 OUT 1 2 3 4 CP WEAR
OTHER LITES STOP L R TAIL L R PARK L R
LICENSE SIDE LITES LF RF LR RR
DIREC SIG LF RF LR RR HOLD CANCEL EMER
BACK-UP LITES L R

BRAKES

PEDAL RESERVE
PARKING BRAKE MECHANISM ADJUST
MASTER CYL LEAKAGE INTERNAL EXT OSKT-SEAL
FRONT BRAKE BALANCE L R
FADE GRAB CHATTER L R
NORMAL STOP L R
PANIC STOP L R
REAR BRAKE BALANCE L R
FADE GRAB CHATTER L R
NORMAL STOP L R
PANIC STOP L R
DRUM F R S HS
DISC F R S
LINING THICKNESS RIV BOND
WHEEL CYL LEAK L R H S CORRODED

FRONT WHEEL ALIGNMENT

CAMBER ANGLE	L	A C	DEGREES
	R		DEGREES
CASTER ANGLE	L	RAD-IALS	DEGREES
	R		DEGREES
TOE ANGLE			DEGREES IN OUT

FLUID LEVELS & CONDITION

ENGINE OIL QTS LO DIRTY O'FULL
TRANSMISSION OIL PTS LO BURNED
MASTER CYLINDER ¼ ½ ¾ MI F R
POWER STEERING LO MT BURNED NOISE
BATTERY ELECTROLYTE LO BELOW PLATES

COOLING SYSTEM OK M NG

RADIATOR SUBST'K LEAK RUSTY BRACKETS
RADIATOR CAP WRONG WEAK TMP CRS
COOLANT RUSTY FOAMY LOW °F
HOSES UP LO BYPASS HEATER 1 2 3 4
BELTS AC PS F G AIR LOOSE
FREEZE PLUGS BLOCK L R HEAD L R
WATER PUMP WORN LEAK
FAN CLUTCH LOOSE SLD RUNS-ON

ELECTRICAL SYSTEM

BATTERY HOLD-DOWN LOOSE MISSING
BATTERY RESERVE CAP. V. CRANKING V.
SULPHATION TEST VOLTS
BATTERY CABLES CORRODED REPLACE P N
STARTER AMPS DRAG NOISY
GEN & REG DIODES VOLTS

EXHAUST SYSTEM

SINGLE SINGLE Y DUAL
EXHAUST PIPE L R LEAK LOOSE
MUFFLER L R LEAK DENTED BAFFLES
RESONATOR L R LEAK DENTED BAFFLES
TAILPIPE L R LEAK LOOSE SHORT
HANGERS BROKEN LOOSE MISSING EL

DRIVE LINE

U JOINTS FITTINGS CLOSED F R 2 3 4 5 6
CONDITION DRY WORN
CARRIER BEARING SUPPORT
DIFFERENTIAL RING & PINION BEARINGS NOISY
REAR AXLE BEARINGS NOISY L R SEALS

STEERING & SUSPENSION

STEERING FREE PLAY
RIDING HEIGHT SPACERS F R
SHOCK ABSORBERS F O R R O R AR
IDLER ARM BUSHING TIE ROD ENDS L R
BUSHINGS CONTROL ARM UP LO / STRUT ROD / STAB
BALL JOINTS UP LO KING PINS LINKS
BRAKE HOSES VISUAL LEAK CRACKED

TIRES & WHEELS

32NDS TREAD REMAINING	LF	RF	
	LR	RR	

WHEEL BALANCE LF RF LR RR
WHEEL BEARINGS LOOSE NOISY REP. L R

SPEEDOMETER ACCURACY

SPEEDO READS		AT 45		AT 55	FOD

ENGINE OK M NG

CRANKING BALANCE POWER BALANCE
VALVES 1 2 3 4 5 6 7 8 STICKY ADJ.
LIFTERS NOISY STICKY VGS
PISTONS PINS BEARINGS / NOISY
COMBUSTION BLOWBY L M H S
SMOKING (DYNO TEST) L M H S
ENGINE MOUNTS L R REAR
HEAD GASKETS INTERNAL/EXTERNAL W O
ROAD HORSEPOWER APPROX 2500 RPM
VACUUM LEAKS MANIFOLD CARB

TRANSMISSION & CLUTCH

UP-SHIFTS KICKDOWN JERK SLIP NOISY
CLUTCH FREE PLAY SLIP CHATTER TOB
AUTO. MAN. 3 4 5

IGNITION SYSTEM

DWELL
DISTRIBUTOR WEAR
IDLE SPEED N D
INITIAL TIMING VSAD VSRD
SPARK ADVANCE AT 2500 RPM VAU
PLUG FIRING VOLTAGE KV/BREAKDOWN
COIL OUTPUT CRANKING KV/RUNNING KV
COIL PATTERN/OIL LEAK/REVERSE POLARITY
SECONDARY WIRES OPEN/OIL SOAKED
CAP AND ROTOR KV
POINTS & CONDENSER PATTERN / V.
ELECT. IGN PU COIL BALLAST CW

FUEL SYSTEM

AIR FILTER OIL BATH
MANIFOLD HEAT VALVE INOPERATIVE STICKY
CHOKE ACTION STICKY/ADJ/CHOKE UNLOADER
ACCELERATOR PUMP INOPERATIVE WEAK
FUEL PUMP NOISY LEAK G O/FLEX LINE U L
DASHPOT ELEC ADJ/HI IDLE CAM/STICKY

CARB	STUMBLE SURGE DIRTY LEAKY	AIR/FUEL RATIOS 1 2 4 2-1 O/	IDLE	
			CRUISE	
			POWER	

THROTTLE PLATES FULL OPEN/SECONDARIES
PCV SYSTEM GV RV AIR PUMP

POLLUTANTS	IDLE	LO CRUISE	HI CRUISE
HC (PPM)			
CO (%)			

OWNER'S PROBLEMS

TEST NOTES

REPAIRS RECOMMENDED

LUBE OIL CHANGE FILTER
ADJ HEADLITES WIPER BLADES L R
REPAIR LITES HORN WASHERS
ADJ BRAKES MAJOR F R MINOR PARK
REBUILD NEW MASTER CYL/WHEEL CYL F R
RECONDITION BRAKES FILL MASTER CYL
ALIGN WHEELS
RADIATOR POWER FLUSH / ROD / REPAIR / COOLANT
RADIATOR CAP / FREEZE PLUGS WATER PUMP / FAN CL
HOSES UP LO BYPASS HEATER 1 2 3 4
BELTS AC PS F G AIR TIGHTEN
BATTERY/STARTER/GEN REG/ CABLES P N/SERVICE
MUFFLER/RESONATOR/EXH PIPE TAILPIPE/HANGERS
U-JOINTS PACK/REPLACE 2 3 4 AS REQ'D
SHOCK ABSORBERS F R LL RR
IDLER ARM/BUSHING/TIE ROD ENDS
BUSHINGS CONTROL ARM UP LO /STRUT ROD/STAB
BALL JOINTS UP LO/KING PINS/LINKS
TIRES LF RF LR RR
BALANCE WHEELS LF RF LR RR/ALL TIRES
WHEEL BEARINGS PACK REPLACE SEALS
HEAD GASKETS VALVES RINGS SHORT BLOCK
ENGINE MOUNTS F R/VAC LEAKS MFLD CARB
TRANSMISSION SERVICE AND ADJUST
CLUTCH ADJUST INSPECT & REPORT REPLACE
ELECTRICAL TUNE-UP - REPLACE PLUGS
SECONDARY WIRES CAP & ROTOR
AIR FILTER FUEL PUMP FLEX LINE U L
CARBURETOR RECONDITION NEW BALANCE
STEAM CLEAN REPORT ON OIL LEAKS
ADJUST DWELL TIMING DASHPOT
STROBE DISTRIBUTOR

PLEASE NOTE

THANK YOU

FIGURE 3
CARDOC MANUAL CHECKSHEET

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8. Noise Testing: None.

9. Fuel Economy: Sun Cylinder Leakage Tester, compression tester
K-D Fuel Injection Manometer, fuel pump tester.

10. Other: Sun Distributor Testers (three)
Miscellaneous Tools:
  - Hydraulic press
  - Engine hoist
  - Axle bending tools
  - Ancillary instrumentation
  - Generator testers (four)
  - Battery starter testers (three).

11. Plans for Replacement: None. CARDOC is no longer operating.

12. Technical Library: National and other manuals
Manufacturers' shop manuals
Sun spec sheets.

13. Mobile Equipment: None.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: Equipment was maintained according to manufacturers' instructions: chassis dynamometers were lubricated and calibrated once a year; other equipment about as frequently. Repairs were performed on an as-needed basis.

2. Frequency of Gas Calibration for Emission Analyzers: Monthly.

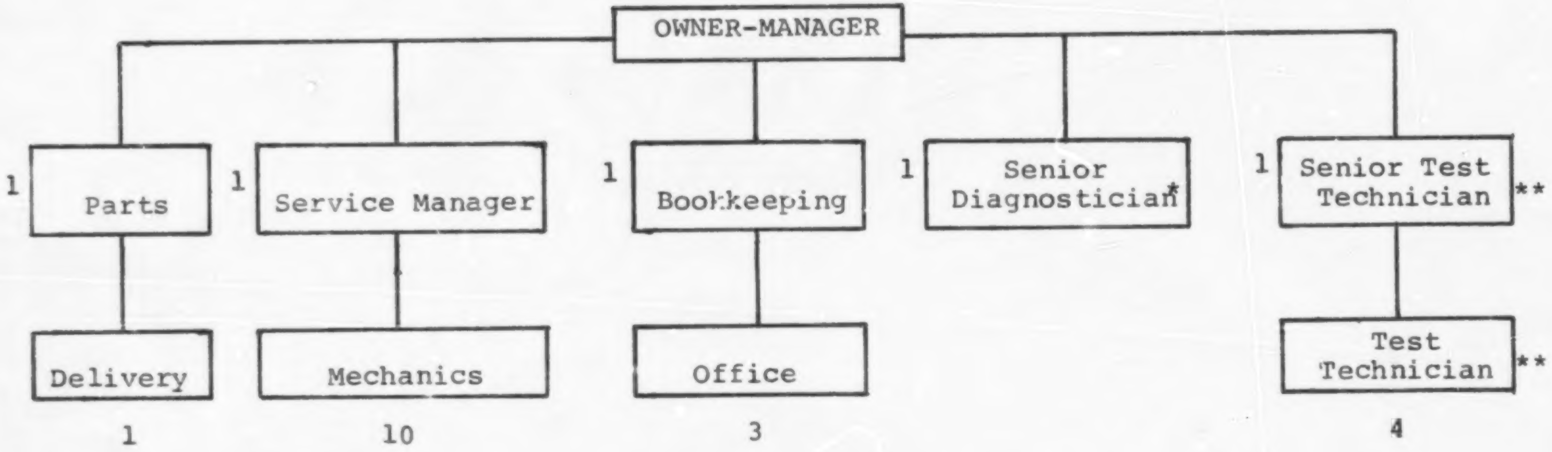
VII. FACILITY STAFFING

Figure 4 illustrates the CARDOC organizational structure.

VIII. TRAINING

1. Inspector Experience Requirements: Inspectors were not required to be master mechanics. CARDOC had the best experience with retired Navy chiefs and Marine master sergeants. All training was done by the manager and test technician. Mechanical aptitude was essential, but previous auto experience was not a requirement.

[redacted]


OWNER-MANAGER
1
Parts
1
Service Manager
1
Bookkeeping
1
Senior Diagnostician*
1
Senior Test Technician**
Delivery
1
Mechanics
10
Office
3
Test Technician**
4

* Provides Counseling.
** Performs diagnostic tests.

FIGURE 4. CARDOC FACILITY STAFFING

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2. Employee Training Provisions: Employees were trained by the owner/operator to detect vehicle problems.

3. Technical Update Meetings: Informal meetings were occasionally held.

IX. QUALITY CONTROL

1. Supervision for Inspectors: The diagnostician and manager were responsible for checking work. The repair shop acted as important feedback for diagnostic accuracy. The Auto Club of Southern California (ACSC) sent undercover cars through the facility every six months and published internal reports on diagnostic accuracy.

2. Surveys of Customer Satisfaction: Early in-house surveys and later AAA surveys were conducted. Results were uniformly favorable according to Mr. Dechant.

3. Criteria for Failure: Original standards, based on the owner's experience and manufacturer standards, were established by CARDOC. These were continually refined through the years.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Most repairs were retested against manufacturer specifications in the quality control bay using a dynamometer and oscilloscope.

XI. CUSTOMER INTERFACE

1. Counseling: The customer was counseled on the vehicle's condition in the diagnostician's office. Estimates of repair costs were provided.

2. Additional Customer Services: Lounge with view of inspection lane, television, magazines, complimentary coffee.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: 30-45 minutes.

2. Time at Each Station in the Lane: The vehicle spent the most time (15 minutes) on the dynamometer, which controlled the flow of the lane.

3. Theoretical Maximum Lane Throughput: Six per hour (achievable only by increasing the number of test technicians from 4 to 6).

[redacted]

4. Average Lane Throughput: Four per hour (4 inspectors).

5. Appointments Used: Yes.

6. Busiest Time of Year: August was the best month and February the slowest month.

7. Maximum Number of Vehicles Processed per Hour for the Entire Facility: Information no longer available.

XIII. CONSUMER AND COMMUNITY RELATIONS

S.D. Employees Association (San Diego)
Independent Garage Owners Association.

XIV. INVESTMENT AND OPERATION COSTS

1. Initial Facility Investment:

1966 Building $105,000
Equipment $65,000, increased to $100,000 through the years.

2. Average Hourly Labor Rate:

1966 - $8/hour flat rate. Mechanics paid 50 percent.
1975 - $14/hour flat rate. Mechanics paid 50 percent.

3. Building and Land Costs:

Building	$105,000
Land	$ 70,000

4. Utilities: (for 1974)

Telephone	$200/month
Gas, Electricity	$150/month
Water	$ 15/month

5. Labor Costs: (for 1974)

Technicians	$5.00/hour	Service Manager	$6.00/hour
Parts	$5.50/hour	Bookkeeper	$3.50/hour
Diagnostician	$6.00/hour	Receptionist	Minimum +

DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: Imperial Esso Diagnostic Clinic
Don Mills Rd. and Shepherd Avenue
Toronto, Canada

2. Contact Name and Number:

- Mr. Pennell (416) 494-6000. Driveway Manager, Don Mills Rd. and Shepherd Avenue Esso Station
- Al Tero (416) 446-4610. Area Supervisor for four Imperial Esso Centers in the Toronto Area.
- Bill Taylor (416) 968-5168.
- Jim Wainwright (416) 968-5172. Taylor and Wainwright were involved in the early development of the diagnostic clinics.

3. General Background: A number of diagnostic clinics were started in 1966 when Imperial Esso, Exxon's Canadian subsidiary, built service centers with attached diagnostic lanes. These diagnostic lanes were considered separate activities from the repair services offered at the centers. In 1966, 60 were started in locations throughout Canada, with the exception of the Atlantic provinces. Of these, only 35 to 40 are still operating. The diagnostic lanes were less popular than Imperial Esso had predicted and were never self-supporting. A slight increase in interest has occurred during the recession as motorists hold onto their cars longer. However, Imperial Esso has no plans for further development or commitment of funds to the diagnostic program. Existing facilities are operated by Servacar, Ltd., a subsidiary of Imperial Esso. The following information is a profile of a typical diagnostic center in Toronto.

4. Vehicle Types Inspected: Passenger vehicles, some foreign cars, diesels; no front-wheel drive cars, vans or trucks over ½ ton.

5. Types of Inspection Services: Brake diagnosis, engine diagnosis, vehicle diagnosis (250 items).

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6. Hours of Operation: M-F 8:00 a.m. to 5:00 p.m.
   Sat 8:00 a.m. to 3:00 p.m.

7. Physical Area of Inspection Facility: 1000-square-foot inspection lane located across street from shopping mall.

8. Inspection Lane Dimensions: 20' x 60'

9. Number of Lanes: One lane which can accommodate up to two cars at once.

10. Queueing Area: Appointments only.

11. Parking Area: Can accommodate 70 cars.

12. Facility Diagram and Location and Equipment: See Figure 1.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: Constructed in 1965 and reconstructed in 1968.

2. Construction Type and Material: Rectangular building with brick body and aluminum face.

3. Patron Accommodations: Glass-enclosed lounge where customer may view the inspection.

4. Ventilation System Design: A four-duct exhaust system (two in front of the pit and two in front of the dynamometer) with a central exhaust fan in the ceiling. A separate ventilation system provides heating, ventilating and air conditioning throughout the building.

5. Safety Accommodations: Standard safety practices are observed.

6. Noise Accommodations: Glass-enclosed lounge. Ceiling tiles to reduce noise.

III. STEPS OF INSPECTION PROCESS

1. Check-In: Diagnostician fills in basic car description on Systems Analysis Report (see Figure 2) and discusses any car problems with customer (5 minutes).

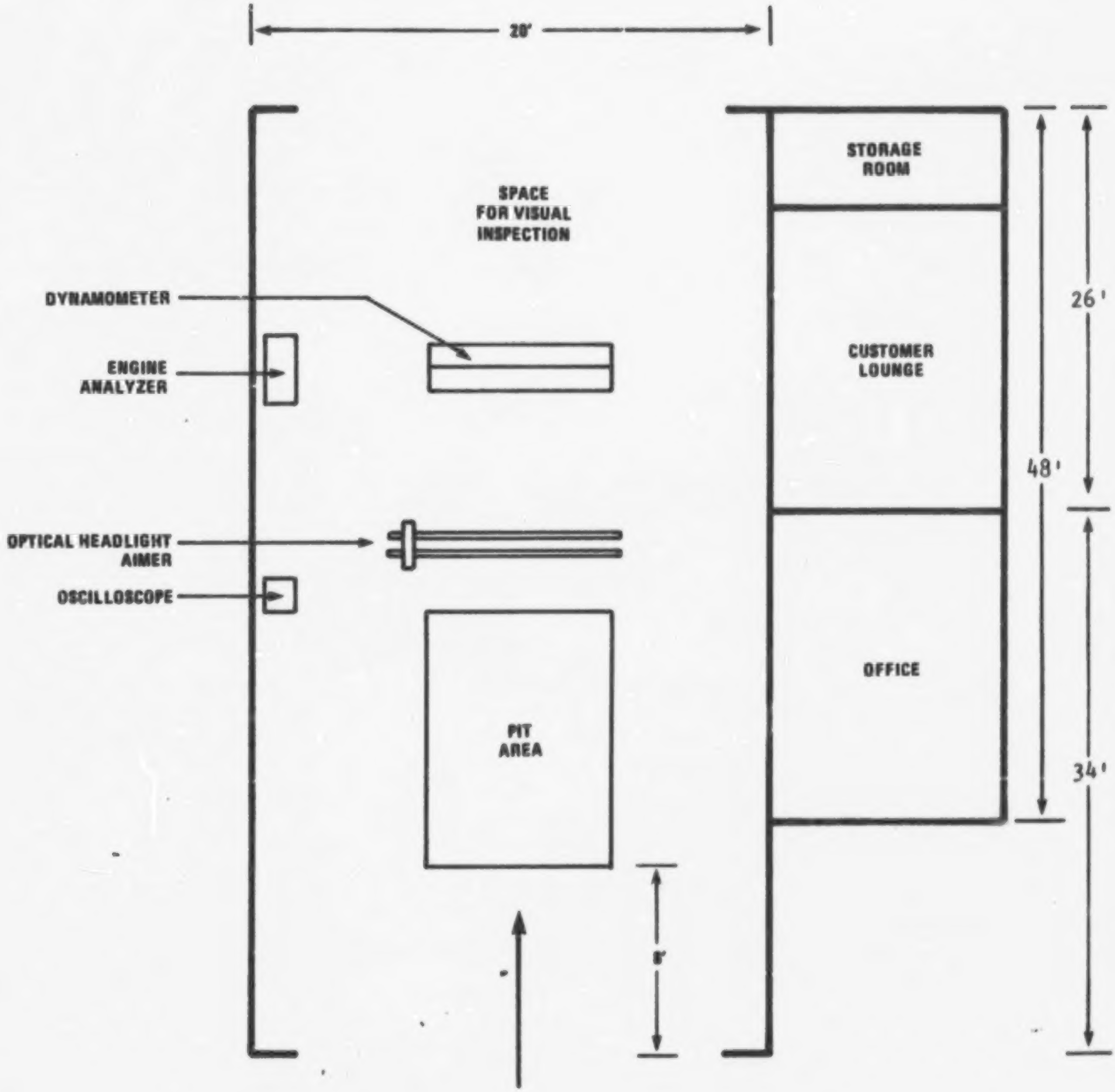
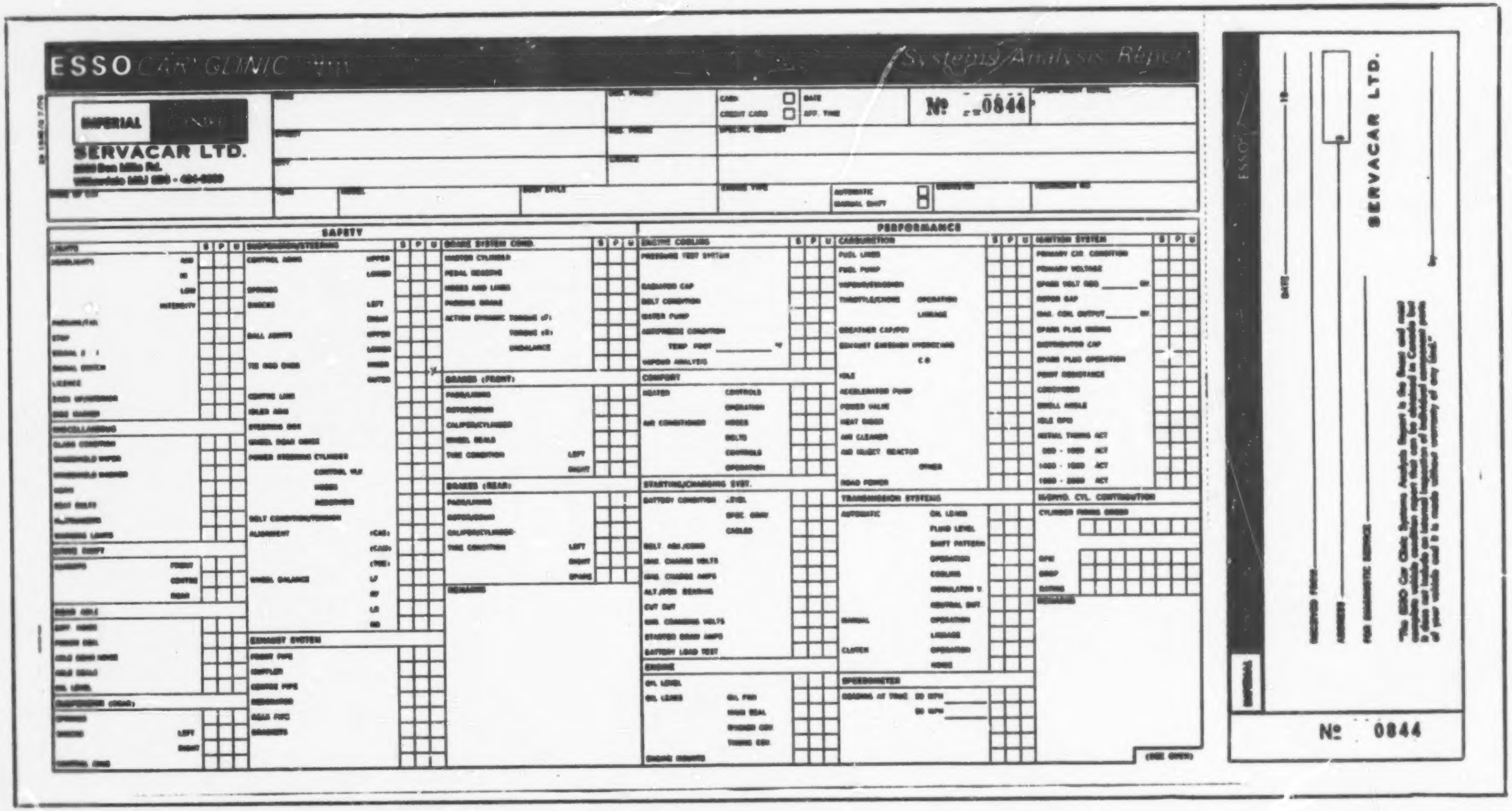

20'
SPACE FOR VISUAL INSPECTION
DYNAMOMETER
ENGINE ANALYZER
OPTICAL HEADLIGHT AIMER
OSCILLOSCOPE
PIT AREA
8'
STORAGE ROOM
CUSTOMER LOUNGE
OFFICE
26'
48'
34'

FIGURE 1. LAYOUT OF IMPERIAL ESSO DIAGNOSTIC CLINIC

256 BEST DOCUMENT AVAILABLE

BEST DOCUMENT AVAILABLE



ESSO CAR CLINIC

Systems Analysis Report

IMPERIAL

SERVACAR LTD.

Nº 0844

SAFETY

PERFORMANCE

SERVACAR LTD.

Nº 0844

FIGURE 2. EXXON CAR CAR CLINIC SYSTEMS ANALYSIS REPORT

207

2. Test Sequence:

- Car moves directly over pit. Visual exterior checks. Inspect horn, lights. Under car check. Inspect shocks, rocker arms, transmission, starter. Pull two wheels (one front, one rear), check brakes, and check exhaust.
- While over pit, perform headlight test.
- Dynamometer. Check brake action, speedometer. Engine test.
- Alignment test.
- Underhood inspection. Check hoses, fluid levels, belts, etc.

3. Data Handling: Inspector uses manual checksheet and checks "Satisfactory," "Postponable" or "Unsatisfactory" category.

4. Check-Out: Customer consultation with diagnostician.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: As needed. Dynamometer is calibrated every 3-4 months.

2. Frequency of Gas Calibration for Emission Analyzer: Not applicable.

VII. FACILITY STAFFING

The complete center staffing:

1. Program Director: One center manager in charge of the entire service center.

2. Station Manager: One service manager in charge of the lanes and bays.

3. Master Mechanics: Seven licensed mechanics/technicians.

4. Junior Mechanics: Two apprentice mechanics.

5. Dignosticians: One senior diagnostician.

6. Aides: One aide to the diagnostician.

7. Clerical: None.

8. Other: Two customer advisors (write orders)
One parts supply person
One driveway manager for pumps
Fifteen pump handlers
Two installation workers (oil changes, grease job)

VIII. TRAINING

1. Mechanic Experience Requirements: All mechanics must be licensed by the government. Licensing process includes apprenticeship period and written examination.

2. Employee Training Provisions: A training program is provided by Imperial Esso. A diagnostician or mechanic may attend four courses per year. Each course is up to two weeks in length and Esso pays the cost.

3. Technical Update Meetings: All mechanics are sent bulletins on any new car developments. In the fall each year, regional clinics are held on new cars. Mechanics may attend up to six one-day clinics a year.

IV. FEES

1. Diagnostic Inspection: $19.95

2. Other Services: Esso can do most repairs including "heavy repair" work such as transmission or engine overhaul.

V. TEST EQUIPMENT

1. Brakes: See Dynamometer.

2. Alignment: Inerta Roll Test Machine, Model 498, made by Curtis-Wright of Canada. The machine measures toe-in and toe-out.

3. Headlight Aim: Weaver.

4. Lift: Pit inspection used.

5. Emission Analyzer: Marquette.

6. Engine Analyzer: Marquette and Allen engine analyzers.

7. Dynamometer: Curtis - Wright Brake/Chassis Dynamometer.

8. Noise Testing: None.

9. Fuel Economy: None.

10. Other: No other major test equipment.

11. Plans for Replacement: No current plans.

12. Technical Library:
Motor Labor Rate and Parts Guide.
Motor Automobile Manuals.

13. Mobile Equipment: None.

IX. QUALITY CONTROL

1. Supervision for Inspectors: The diagnostician would report to the service manager if any problems developed.

2. Surveys of Customer Satisfaction: Imperial studies have shown favorable consumer response.*

3. Criteria for Failure: The diagnostic clinics use standards established by the car manufacturers. Items are rated satisfactory/postponable/unsatisfactory.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Imperial Esso had a reinspection program which was test marketed in Toronto in 1966. Following a diagnostic inspection and repair, the customer could get a free reinspection up to three months later in order to check the quality of the repair work. According to Imperial Esso spokesmen, the program lasted two years and was cancelled due to high losses (approximately $75,000) and customer abuse of the services.*

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* More detailed information not available.

XI. CUSTOMER INTERFACE

1. Counseling: The diagnostician and customer review the report in the consultation booth (5-10 minutes). The diagnostician fully explains the report. No estimates are given.

2. Additional Customer Services: After the consultation, if the customer wants repairs performed, the diagnostician, the customer and the service manager will discuss the type of work that needs to be done. The service manager will then make an estimate, without examining the car himself.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: 45-50 minutes—2 man inspection team (including 5 minute pre-inspection consultation and 5-10 minutes post-inspection review).

2. Time at Each Station in the Lane:

   - Pit Area (13 minutes)
   - Headlight test (1 minute)
   - Dynamometer (15 minutes)
   - Scuff gauge alignment test (1 minute)
   - Underhood inspection (5 minutes).

3. Theoretical Maximum Lane Throughput: 10 vehicles/day.

4. Average Lane Throughput: 8 vehicles/day.

5. Appointments Used: Yes.

6. Busiest Time of Year: May, June, September, October.

7. Maximum Number of Vehicles Processed for the Entire Facility (Diagnostic Lane): 10 vehicles/day.

XIII. CONSUMER AND COMMUNITY RELATIONS

Member of Better Business Bureau.

XIV. INVESTMENT AND OPERATING COSTS

Current average hourly labor rate of $24.00/hour.

COMMERCIAL DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: J.C. Penney Diagnostic Lane
3236 Kirkwood Highway
Wilmington, Delaware 19808

2. Contact Name and Number: Jim Coombs
Lane Diagnostician
(302) 998-1131

Paul Warrant
Service Center Manager
(302) 998-1131

3. General Description of Facility: The Wilmington, Delaware diagnostic lane is the single remaining diagnostic lane in the nationwide chain of Penney's auto repair centers. The center offers a vehicle diagnostic inspection, including engine analysis, scuff test and dynamic brake test. The procedure takes about one hour per vehicle and is performed by a single diagnostician. Penneys schedules only two diagnostic inspections a day.

4. Vehicle Types Inspected: Will inspect any vehicle that can fit through the door, including pick-up trucks up to 1-ton. Will not take cars with studded tires.

5. Types of Inspection Services: Three inspection services are available, a 98-item diagnostic test, an engine test and a speedometer check.

6. Hours of Operation: The diagnostic center schedules just two appointments per day, 12:30 p.m. and 2:00 p.m. Each appointment takes approximately one hour. (In previous years the lane was operated 8 hours a day). The lane is not used for any other services.

7. Physical Area of Inspection Facility: The diagnostic lane and customer waiting area cover approximately 1,100 square feet. The diagnostic lane is located at the far end of the Penney's Automotive Service Center in a large suburban shopping mall.

8. Inspection Station Dimensions: The diagnostic inspection area is 22' x 52'.

9. Number of Lanes/Bays: One diagnostic lane. The Automotive Service Center, in addition, is equipped with several repair bays.

10. Lane Dimensions: The inspection lane is 16' x 52'.

11. Queueing Area: No queueing area is required since inspections are performed on an appointment basis only.

12. Parking Area: The diagnostic lane is located in a large shopping mall with plenty of parking area.

13. Facility Diagram and Location of Equipment: See Figure 1.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: The Penney's Service Center was built in 1965. The diagnostic lane was added to the building around 1969.

2. Building Style and Materials: Cinder block, with brick exterior, warehouse style construction.

3. Patron Accommodations in Addition to Lane: Customer waiting room and viewing area. A large panel of colored displays in the waiting room communicates some of the results to the motorist—such as "Pounds of Braking Force," "Brake Balance," and other descriptors. The panels are very simplistic but are designed to increase the customer's interest in the inspection process. In addition, the results of the inspection process are automatically typed on a pre-printed results sheet by an IBM typewriter located in the customer waiting area. The diagnostician keys in the results data and it is immediately printed out as the inspection proceeds.

4. Ventilation System Design: The diagnostic lane contains metal exhaust hoses which are hooked up to the car during the winter months. The air is exhausted to the outside of the building. During the summer, the doors at either end of the lane are kept open for ventilation.

5. Safety Accommodations: The lane has very little in the way of special safety accommodations. Customers are not permitted in the diagnostic lane.

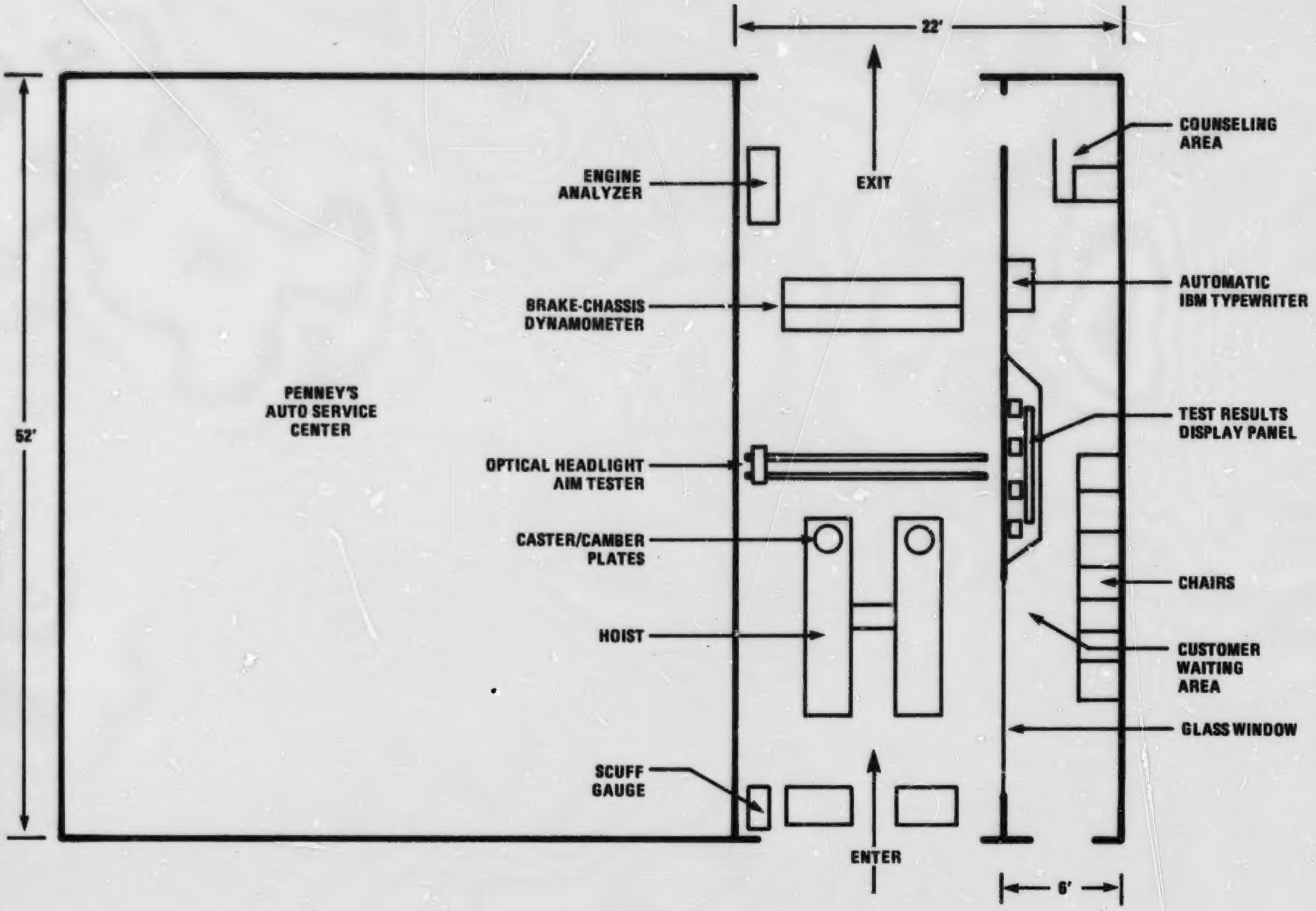
22'
EXIT
COUNSELING AREA
ENGINE ANALYZER
AUTOMATIC IBM TYPEWRITER
BRAKE-CHASSIS DYNAMOMETER
PENNEY'S AUTO SERVICE CENTER
52'
TEST RESULTS DISPLAY PANEL
OPTICAL HEADLIGHT AIM TESTER
CASTER/CAMBER PLATES
CHAIRS
HOIST
CUSTOMER WAITING AREA
GLASS WINDOW
SCUFF GAUGE
ENTER
6'

FIGURE 1. LAYOUT OF PENNEY'S DIAGNOSTIC LANE

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6. Noise Accommodations: The dynamometer is not equipped with sound deadening rolls. A glass window separates the customer viewing area from the diagnostic lane. No other special noise accommodations have been added to the lane.

III. STEPS OF INSPECTION PROCESS

1. Check-In: The motorist goes to the main desk of the automotive service center and a standard J.C. Penney work order is prepared. Either the motorist or the diagnostician can then drive the car to the inspection lane. The motorist has the option of waiting at the main desk or walking back to observe the diagnostic inspection.

2. Test Sequence: The diagnostic checklist identifying all of the tests is shown in Figure 2. The general sequence of the test is as follows:

   - Scuff Gauge and Alignment Check
   - Vehicle on Lift
     - Pull 1 wheel to check brakes
     - Check front end
     - Check for leaks, exhaust system integrity
   - Vehicle on Dynamometer
     - Engine analysis
     - Exhaust emission analysis
     - Check speedometer, drivetrain
     - Brake balance and force.

3. Data Handling: The inspection results are automatically typed onto the diagnostic test form which lists 98 inspection items. Using a handheld data input device, the diagnostician keys in the number of the inspection item and a standardized rating of either "Good" or "Needs attention." When the inspection is finished, the inspector will manually write or type further details directly onto the form explaining the items that need attention. Copies of the forms are filed by date and customer name.

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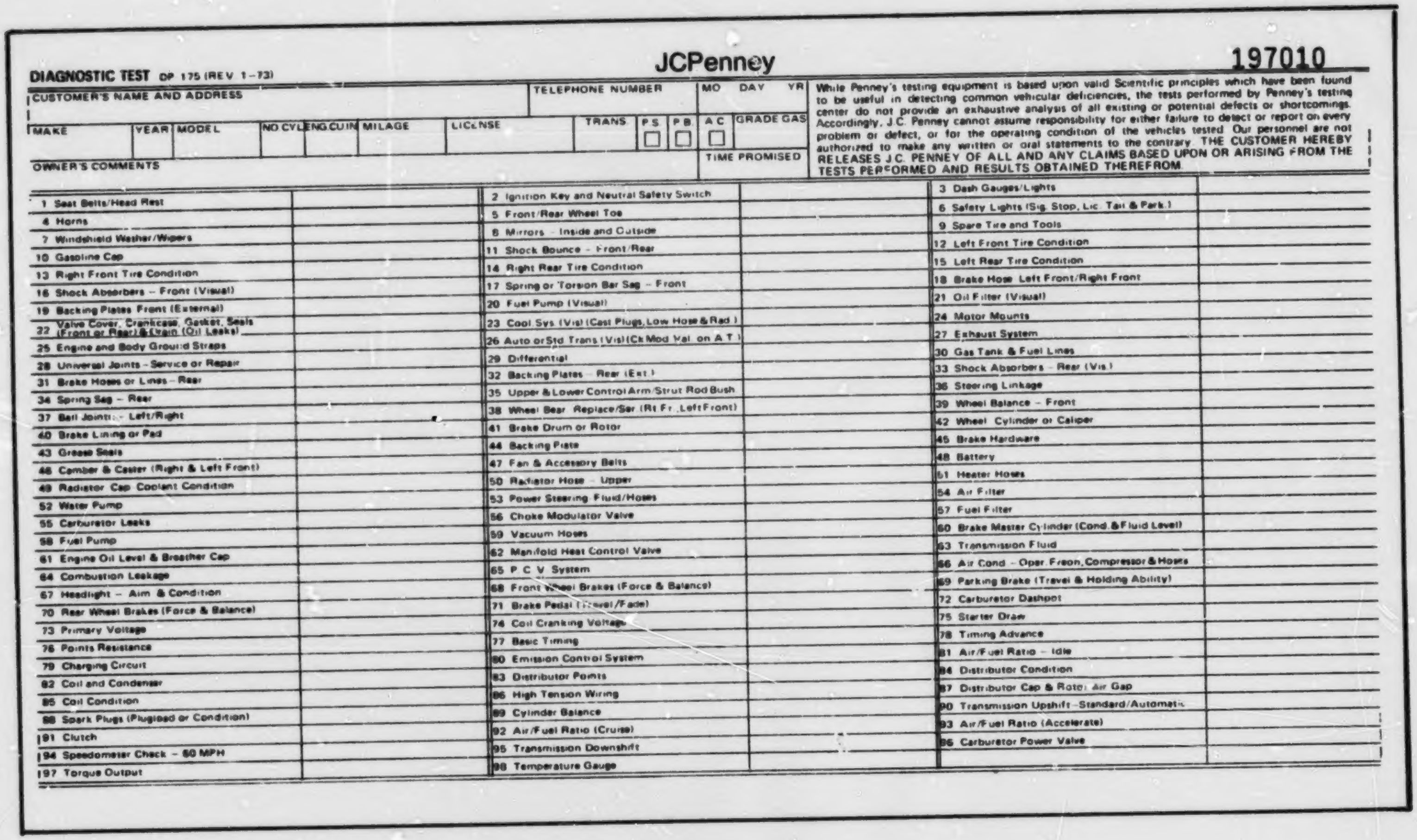


DIAGNOSTIC TEST DP 175 (REV 1–73)

JCPenney

197010

CUSTOMER'S NAME AND ADDRESS
TELEPHONE NUMBER
MO DAY YR

MAKE | YEAR | MODEL | NO CYL | ENG.CU IN | MILAGE | LICENSE | TRANS | P S ☐ | P B ☐ | A C ☐ | GRADE GAS

OWNER'S COMMENTS
TIME PROMISED

While Penney's testing equipment is based upon valid Scientific principles which have been found to be useful in detecting common vehicular deficiencies, the tests performed by Penney's testing center do not provide an exhaustive analysis of all existing or potential defects or shortcomings. Accordingly, J.C. Penney cannot assume responsibility for either failure to detect or report on every problem or defect, or for the operating condition of the vehicles tested. Our personnel are not authorized to make any written or oral statements to the contrary. THE CUSTOMER HEREBY RELEASES J.C. PENNEY OF ALL AND ANY CLAIMS BASED UPON OR ARISING FROM THE TESTS PERFORMED AND RESULTS OBTAINED THEREFROM.

1 Seat Belts/Head Rest
4 Horns
7 Windshield Washer/Wipers
10 Gasoline Cap
13 Right Front Tire Condition
16 Shock Absorbers – Front (Visual)
19 Backing Plates Front (External)
22 Valve Cover, Crankcase, Gasket, Seals (Front or Rear) & Drain (Oil Leaks)
25 Engine and Body Ground Straps
28 Universal Joints – Service or Repair
31 Brake Hoses or Lines – Rear
34 Spring Sag – Rear
37 Ball Joints – Left/Right
40 Brake Lining or Pad
43 Grease Seals
46 Camber & Caster (Right & Left Front)
49 Radiator Cap Coolant Condition
52 Water Pump
55 Carburetor Leaks
58 Fuel Pump
61 Engine Oil Level & Breather Cap
64 Combustion Leakage
67 Headlight – Aim & Condition
70 Rear Wheel Brakes (Force & Balance)
73 Primary Voltage
76 Points Resistance
79 Charging Circuit
82 Coil and Condenser
85 Coil Condition
88 Spark Plugs (Plugload or Condition)
91 Clutch
94 Speedometer Check – 60 MPH
97 Torque Output

2 Ignition Key and Neutral Safety Switch
5 Front/Rear Wheel Toe
8 Mirrors – Inside and Outside
11 Shock Bounce – Front/Rear
14 Right Rear Tire Condition
17 Spring or Torsion Bar Sag – Front
20 Fuel Pump (Visual)
23 Cool. Sys. (Vis) (Cast Plugs, Low Hose & Rad.)
26 Auto or Std Trans (Vis) (Ck Mod Val. on A.T.)
29 Differential
32 Backing Plates – Rear (Ext.)
35 Upper & Lower Control Arm/Strut Rod Bush
38 Wheel Bear. Replace/Ser (Rt Fr., Left Front)
41 Brake Drum or Rotor
44 Backing Plate
47 Fan & Accessory Belts
50 Radiator Hose – Upper
53 Power Steering Fluid/Hoses
56 Choke Modulator Valve
59 Vacuum Hoses
62 Manifold Heat Control Valve
65 P.C.V. System
68 Front Wheel Brakes (Force & Balance)
71 Brake Pedal (Travel/Fade)
74 Coil Cranking Voltage
77 Basic Timing
80 Emission Control System
83 Distributor Points
86 High Tension Wiring
89 Cylinder Balance
92 Air/Fuel Ratio (Cruise)
95 Transmission Downshift
98 Temperature Gauge

3 Dash Gauges/Lights
6 Safety Lights (Sig. Stop, Lic. Tail & Park.)
9 Spare Tire and Tools
12 Left Front Tire Condition
15 Left Rear Tire Condition
18 Brake Hose Left Front/Right Front
21 Oil Filter (Visual)
24 Motor Mounts
27 Exhaust System
30 Gas Tank & Fuel Lines
33 Shock Absorbers – Rear (Vis.)
36 Steering Linkage
39 Wheel Balance – Front
42 Wheel Cylinder or Caliper
45 Brake Hardware
48 Battery
51 Heater Hoses
54 Air Filter
57 Fuel Filter
60 Brake Master Cylinder (Cond. & Fluid Level)
63 Transmission Fluid
66 Air Cond. – Oper. Freon, Compressor & Hoses
69 Parking Brake (Travel & Holding Ability)
72 Carburetor Dashpot
75 Starter Draw
78 Timing Advance
81 Air/Fuel Ratio – Idle
84 Distributor Condition
87 Distributor Cap & Rotor Air Gap
90 Transmission Upshift – Standard/Automatic
93 Air/Fuel Ratio (Accelerate)
96 Carburetor Power Valve

FIGURE 2. PENNEY'S DIAGNOSTIC TEST CHECKLIST

4. Check-Out: The diagnostician reviews the inspection results with the customer and provides a copy of the results. He will provide a general estimate of the cost of repairs at Penney's. Generally, the counseling sessions last ten minutes.

5. Comments: The Penney's diagnostic lane receives very little attention from either the Wilmington Penney's management or the Penney's New York office. As the only remaining lane in operation, it seems to be operated more as a service than as a serious revenue-producing entity. The lane contains some outdated non-operating equipment that has not been moved or replaced (Bear caster-camber plates). According to the lane diagnostician, an estimated 50 percent of lane customers seek repair work at Penney's.

IV. FEES (as of July, 1980)

1. Diagnostic Inspection: $20.88

2. Other Services: Other inspection services include an engine analysis, $14.88, and a speedometer check, $4.00. Re-checks are no charge.

Repair services and fees offered by Penney's Auto Center are posted in the counseling area. These include:

- Wheel alignment $13.88
- Brake adjustment $3.50 each
- Lubrication $3.75
- Wheel Balance $2.75 each
- Tune-up (including parts)
    - 4 Cylinder $33.88
    - 6 Cylinder $38.88
    - 8 Cylinder $43.88
- Spin Balance $4.50 each.

V. TEST EQUIPMENT

1. Brakes: (1) Marquette Brake-Chassis Dynamometer. Also, while the car is on the lift, one wheel is pulled.

2. Alignment: (1) Bear True-Toe Scuff Gauge #246. Bear caster-camber plates are installed in front of the hoist but are no longer working.

3. Headlight Aim: (1) Bear Headlight Tester #561.

4. Lift: (1) Globe hoist.

5. Emission Analyzer: (1) Marquette (no model number available).

6. Engine Analyzer: Sun Tune-Up Tester #1015.

7. Dynamometer: (1) Marquette Brake-Chassis Dynamometer and a Marquette "Diagnostic Center." The Diagnostic Center displays results for brake balance, brake force and torque output. The center was initially designed to serve as an engine analyzer as well, but its functions are outdated and thus no longer used. The Sun engine analyzer provides this capability.

8. Noise Testing: None.

9. Fuel Economy: None.

10. Other: (1) Sun VAT-40 used to test the charging and starting systems and the battery.

11. Plans for Replacement: None.

12. Technical Library: A set of J.C. Penney's Car Care Guides published by Chek-Chart is available in the lane. This is the principal reference source. Miscellaneous other literature is available including Motor Manuals, Champion Spark Plug literature, etc.

13. Mobile Equipment: None.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: Occasional maintenance is performed by the Penney's staff. When the equipment is observed to be malfunctioning, an equipment service technician is called. On the day the lane was visited, the dynamometer was only partially operational due to a broken hydraulic line. Three weeks later, Penney's was still waiting for a local technician to come and fix the line.

2. Frequency of Gas Calibration for Emission Analyzer: The diagnostician did not know when or if the emission analyzer is gas calibrated since such service was not specified in the operating manual. Minor maintenance such as replacing filters and draining the water trap is performed by the diagnostician. The analyzer is electronically calibrated before every test.

VII. FACILITY STAFFING

1. Program Director: No position.

2. Station Manager: (1) Paul Warrant.

3. Master Mechanics: None in diagnostic lane.

4. Junior Mechanics: None in diagnostic lane.

5. Diagnosticians: (1) Jim Coombs—has responsibility for the diagnostic lane. Two other people are available to substitute when Jim is on vacation.

6. Aides: None in diagnostic lane.

7. Clerical: None.

8. Other: None.

VIII. TRAINING

1. Inspector Experience Requirements: The primary diagnostician for the lane has 10 years experience as a mechanic. He doubles as a service manager when he is not in the diagnostic lane. He typically spends 16 hours a week in the lane and 24 hours as a service manager.

2. Employee Training Provisions: Penney's operates an automotive training center in Atlanta, Georgia. The company periodically sponsors attendance by the mechanics at the training courses in Atlanta.

3. Technical Update Meetings: The staff reads the monthly Chek-Chart Service Bulletin which describes new automotive systems. No formal meetings are held.

IX. QUALITY CONTROL

1. Supervision for Inspectors: The diagnostician is almost completely responsible for the diagnostic lane. Little supervision is provided, possibly due to the fact that only two inspections are performed daily.

2. Surveys of Customer Satisfaction: None.

3. Criteria for Failure: Vehicle parameters/components are rated either "Good" or "Needs attention." The diagnostician depends on his experience to guide him in making these judgments, supplemented by the vehicle specifications. For engine adjustments and emissions levels, he refers to the manufacturer's label on the engine or to the Chek-Chart guide.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Limited reinspections are performed at no charge.

XI. CUSTOMER INTERFACE

1. Counseling: The diagnostician explains the inspection results to the customer and will provide an oral estimate of needed repair work. The diagnostician will spend as much time as necessary to explain the results. Typically, the counseling time is 10 minutes.

2. Additional Customer Services: Customer services at the diagnostic lane include:

   - Air conditioned waiting area with full view of the inspection lane.

   - Immediate printout of test results on IBM typewriter in waiting room.

- Colored display giving numeric results on brake balance, brake force and selected other test items.
- The diagnostician will correct the adjustment of the idle/fuel mixture screw if available/accessible while the car is being tested on the engine analyzer.

Additional services are provided by the Penney's Auto Service Center.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: Approximately one and a quarter to one and a half hours per vehicle.

2. Time at Each Station in the Lane:

   - Scuff Gauge - 1 minute
   - Vehicle on Lift - 20-25 minutes
   - Vehicle on Dynamometer - 40 minutes
   - Counseling - 10-15 minutes
   - Total - 71-81 minutes.

3. Theoretical Maximum Lane Throughput: Only two vehicles per day are inspected by Penney's. Higher throughput would depend on the number of hours the lane is kept in operation. In previous years, with two full-time inspectors, the lane handled 10-12 cars per day. With one full-time inspector, the lane can handle six cars per day.

4. Average Lane Throughput: Currently two per day.

5. Appointments Used: Yes.

6. Busiest Time of Year: Spring.

7. Maximum Number of Vehicles Processed per Hour for the Entire Facility: The total number of vehicles handled by the lane is 2/day excluding cancellations. Appointments are made in advance.

XIII. CONSUMER AND COMMUNITY RELATIONS

In previous years, Penney's sponsored cooperative work/study programs for students. There is currently no community outreach program or other local activity.

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment: Information not available.
2. Current Average Hourly Labor Rate: Penney's hourly service rate is $15.00/hour. Mechanic wages range from $3.50/hour for a tire changer to $7.00/hour for a senior mechanic plus 10 percent of selected repair labor.
3. Building and Land Costs: Information not available.
4. Utilities: Diagnostic lane uses only electricity to power the test equipment. Rates were not available.
5. Other Costs: The weekly salary for the diagnostician for 16 hours in the lane is approximately $120.

DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: Montgomery Ward's Diagnostic Center
Seven Corners Mall
6100 Arlington Boulevard
Falls Church, Virginia

2. Contact Name and Number: Frank Baptiste (Foreman)
Greg Chamblie (Diagnostician)
J. A. Barnes (Operating Manager)
Ed Donahue (Store Manager)

3. General Description of Facility: Montgomery Ward's Diagnostic Center is part of a large (18 bay) repair facility at a shopping mall. Ward's offers a full diagnostic inspection using mostly Sun and Maxwell equipment.

4. Vehicle Types Inspected: All American passenger cars, vans and light duty trucks. No foreign vehicles. No front-wheel drive cars.

5. Type of Inspection Services: Diagnostic inspection service.

6. Operating Hours: M-W, F and Sat. 8:30 a.m. - 4:30 p.m.

7. Physical Area of Inspection Facility: Diagnostic lane and service bays are attached to Ward's showroom at Seven Corners Mall.

8. Inspection Lane Dimensions: 18' x 75' diagnostic lane.

9. Number of Lanes/Bays: One Diagnostic Lane
18 Service Bays

10. Queueing Area: Not required due to appointment system.

11. Parking Area: There is parking for 50 or more vehicles in the surrounding shopping center

12. Facility Diagram and Location of Equipment: See Figure 1.

BEST DOCUMENT AVAILABLE

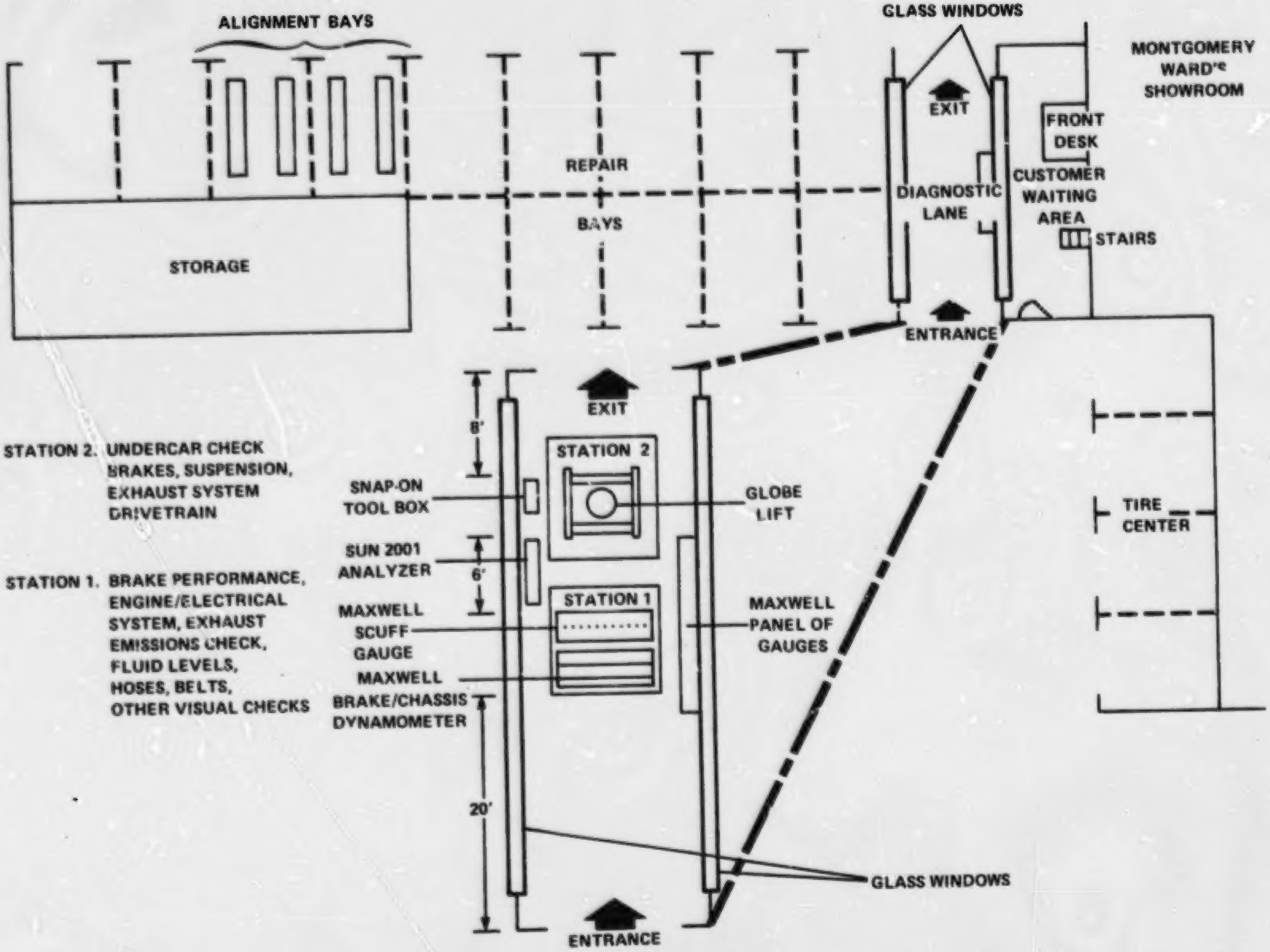

ALIGNMENT BAYS
GLASS WINDOWS
MONTGOMERY WARD'S SHOWROOM
EXIT
FRONT DESK
REPAIR
BAYS
DIAGNOSTIC LANE
CUSTOMER WAITING AREA
STAIRS
STORAGE
ENTRANCE
EXIT
8'
STATION 2. UNDERCAR CHECK BRAKES, SUSPENSION, EXHAUST SYSTEM DRIVETRAIN
STATION 2
SNAP-ON TOOL BOX
GLOBE LIFT
TIRE CENTER
SUN 2001 ANALYZER
6'
STATION 1. BRAKE PERFORMANCE, ENGINE/ELECTRICAL SYSTEM, EXHAUST EMISSIONS CHECK, FLUID LEVELS, HOSES, BELTS, OTHER VISUAL CHECKS
STATION 1
MAXWELL SCUFF GAUGE
MAXWELL PANEL OF GAUGES
MAXWELL BRAKE/CHASSIS DYNAMOMETER
20'
GLASS WINDOWS
ENTRANCE

FIGURE 1. MONTGOMERY WARDS DIAGNOSTIC CENTER DIAGRAM

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: 1966.

2. Construction Type and Material: Brick and steel. L-shaped building.

3. Patron Accommodations: Customers may view entire inspection process from glass-enclosed, air-conditioned viewing area.

4. Ventilation System Design: One large ceiling exhaust fan with two floor ducts. In winter, use hoses connected to the exhaust pipes. In summer, the doors are kept open.

5. Safety Accommodations: Normal safety procedures are followed.

6. Noise Accommodations: Glass-enclosed customer viewing area.

III. STEPS OF INSPECTION PROCESS

1. Check-In: Discussion with diagnostician.

2. Test Sequence:

   - Brake chassis dynamometer includes a check of speed, balance, left-right wheel vibration and horsepower.

   - Computerized engine analyzer with a check of the engine/electrical system and exhaust emissions.

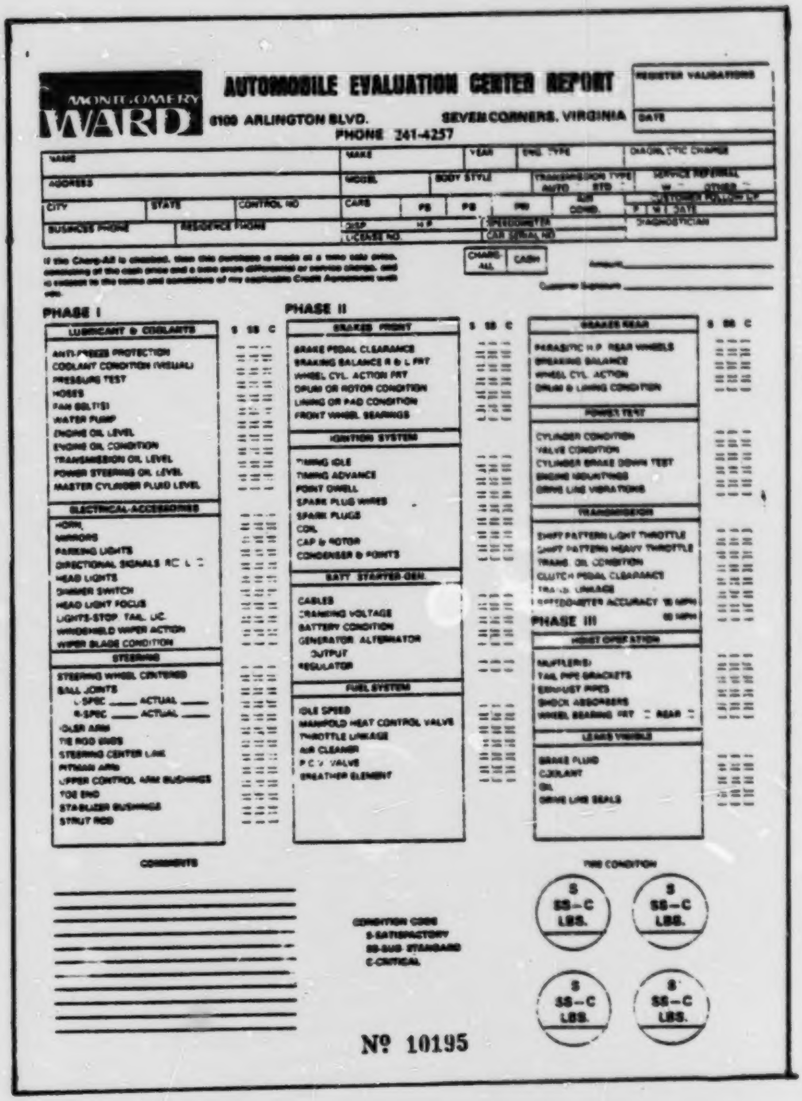
   - Lift: two wheels are pulled (right front and rear).

   - Visual check of suspension, exhaust and drivetrain.

3. Data Handling: Manual checksheet (see Figure 2) and engine analyzer printout sheet.

4. Check-Out: Customer is given a printout and a checklist with items marked standard/substandard/critical. Diagnostician will fully explain both forms and identify the critical areas.

[redacted]



MONTGOMERY WARD

AUTOMOBILE EVALUATION CENTER REPORT

6100 ARLINGTON BLVD.
SEVEN CORNERS, VIRGINIA
PHONE 241-4257

REGISTER VALIDATIONS
DATE

NAME
MAKE
YEAR
ENG. TYPE
DIAGNOSTIC CHARGE
ADDRESS
MODEL
BODY STYLE
TRANSMISSION TYPE AUTO STD
SERVICE REFERRAL W OTHER
CITY
STATE
CONTROL NO
CARS
PS
PB
PW
AIR COND.
CUSTOMER FOLLOW UP
P M DATE
BUSINESS PHONE
RESIDENCE PHONE
DISP
H.P.
SPEEDOMETER
LICENSE NO.
CAR SERIAL NO.
DIAGNOSTICIAN

CHARG-ALL
CASH

Amount ________________

Customer Signature ________________

PHASE I

LUBRICANT & COOLANTS	S	SS	C
ANTI-FREEZE PROTECTION			
COOLANT CONDITION (VISUAL)			
PRESSURE TEST			
HOSES			
FAN BELT(S)			
WATER PUMP			
ENGINE OIL LEVEL			
ENGINE OIL CONDITION			
TRANSMISSION OIL LEVEL			
POWER STEERING OIL LEVEL			
MASTER CYLINDER FLUID LEVEL			
ELECTRICAL-ACCESSORIES			
HORN			
MIRRORS			
PARKING LIGHTS			
DIRECTIONAL SIGNALS R ☐ L ☐			
HEAD LIGHTS			
DIMMER SWITCH			
HEAD LIGHT FOCUS			
LIGHTS-STOP, TAIL, LIC.			
WINDSHIELD WIPER ACTION			
WIPER BLADE CONDITION			
STEERING			
STEERING WHEEL CENTERED			
BALL JOINTS			
L-SPEC ____ ACTUAL ____			
R-SPEC ____ ACTUAL ____			
IDLER ARM			
TIE ROD ENDS			
STEERING CENTER LINK			
PITMAN ARM			
UPPER CONTROL ARM BUSHINGS			
TOE END			
STABILIZER BUSHINGS			
STRUT ROD			

PHASE II

BRAKES FRONT	S	SS	C
BRAKE PEDAL CLEARANCE			
BRAKING BALANCE R & L FRT			
WHEEL CYL. ACTION FRT			
DRUM OR ROTOR CONDITION			
LINING OR PAD CONDITION			
FRONT WHEEL BEARINGS			
IGNITION SYSTEM			
TIMING IDLE			
TIMING ADVANCE			
POINT DWELL			
SPARK PLUG WIRES			
SPARK PLUGS			
COIL			
CAP & ROTOR			
CONDENSER & POINTS			
BATT. STARTER-GEN.			
CABLES			
CRANKING VOLTAGE			
BATTERY CONDITION			
GENERATOR ALTERNATOR OUTPUT			
REGULATOR			
FUEL SYSTEM			
IDLE SPEED			
MANIFOLD HEAT CONTROL VALVE			
THROTTLE LINKAGE			
AIR CLEANER			
P.C.V. VALVE			
BREATHER ELEMENT			

BRAKES REAR	S	SS	C
PARASITIC H.P. REAR WHEELS			
BREAKING BALANCE			
WHEEL CYL. ACTION			
DRUM & LINING CONDITION			
POWER TEST			
CYLINDER CONDITION			
VALVE CONDITION			
CYLINDER BRAKE DOWN TEST			
ENGINE MOUNTINGS			
DRIVE LINE VIBRATIONS			
TRANSMISSION			
SHIFT PATTERN LIGHT THROTTLE			
SHIFT PATTERN HEAVY THROTTLE			
TRANS. OIL CONDITION			
CLUTCH PEDAL CLEARANCE			
TRANS. LINKAGE			
SPEEDOMETER ACCURACY [illegible] MPH			
[illegible] MPH			

PHASE III

HOIST OPERATION	S	SS	C
MUFFLER(S)			
TAIL PIPE BRACKETS			
EXHAUST PIPES			
SHOCK ABSORBERS			
WHEEL BEARING FRT ☐ REAR ☐			
LEAKS VISIBLE			
BRAKE FLUID			
COOLANT			
OIL			
DRIVE LINE SEALS			

COMMENTS

CONDITION CODE
S-SATISFACTORY
SS-SUB STANDARD
C-CRITICAL

TIRE CONDITION

S
SS—C
LBS.

S
SS—C
LBS.

S
SS—C
LBS.

S
SS—C
LBS.

№ 10195

FIGURE 2. MONTGOMERY WARD DIAGNOSTIC REPORT

[redacted]

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IV. FEES

1. Diagnostic Inspection: $18.95 for complete diagnosis.

2. Other Services: Ward's will check various individual parts of the car in the service bays, but not in the diagnostic lane. Fifty percent of the people who have diagnostic work done also get repairs. Diagnosticians do speedometer calibration checks in the morning.

V. TEST EQUIPMENT

1. Brakes: Maxwell Dynamometer/Brake Tester.

2. Alignment: Maxwell Scuff Gauge.

3. Headlight Aim: None.

4. Lift: Globe double-post lift.

5.&6. Emission/Engine Analyzer: Sun 2001 (analyzer) and 2002 (printer) (replacement cost: $30,000).

7. Dynamometer: See Brakes.

8. Noise Testing: None.

9. Fuel Economy: None.

10. Other: None.

11. Plans for Replacement: Ward's has no plans to replace its equipment at this time.

12. Technical Library: Information not available.

13. Mobile Equipment: None.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Maintenance: Every 2-3 weeks, for all equipment that requires it.

2. Frequency of Gas Calibration for Emission Analyzer: Calibration peformed only when Sun's gauge indicates calibration required.

VII. FACILITY STAFFING

1. Program Director: Foreman (1).

2. Station Manager: Service Manager (1).

3. Master Mechanics: 15.

4. Junior Mechanics: None.

5. Diagnosticians:* One (will be training two more).

6. Aides: None.

7. Clerical: Two.

8. Other: Three Service Writers.

VIII. TRAINING

1. Diagnostician Experience Requirements: Require a NIASE certification, State inspection certificate. Diagnostician must attend equipment seminar taught by Avocation Ltd. (one week in the evenings).

2. Employee Training Provisions: Ward's pays for diagnostician to attend equipment seminar ($150). Diagnosticians and mechanics may also attend GM training sessions in Fairfax. This opportunity is available because Ward's sells AC spark plugs.

3. Technical Update Meetings: Car manufacturer training sessions attended. Sun will come by and update diagnosticians as needed.

IX. QUALITY CONTROL

1. Supervision for Inspectors: Service manager and foremen respond to complaints.

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* All inspections are performed by the diagnostician.

2. Surveys of Customer Satisfaction: None.

3. Criteria for Failure: Use manufacturer specifications and State inspection standards.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

No special reinspection policy.

XI. CUSTOMER INTERFACE

1. Counseling: Diagnostician will present checksheet and printout to customer explaining the critical areas.

2. Additional Customer Services: Customers may observe inspections from customers viewing area. (Safety regulations prohibit customers in work area.)

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time Per Vehicle: 45 minutes for inspection
15 minutes for counseling
60 minutes total

2. Time at Each Station in the Lane: Information not available.

3. Theoretical Maximum Lane Throughput: Seven per day.

4. Average Lane Throughput: Five per day.

5. Appointments Used: Yes.

6. Busiest Time of Year: April, May, July.

7. Maximum Number of Vehicles Processed Per Hour for the Entire Diagnostic Facility: 1.0.

XIII. CONSUMER AND COMMUNITY RELATIONS

The store is a member of the Chamber of Commerce and the United Way. Ed Donahue, the store manager, is on the Fairfax County Advisory Board for distributive education and Adult Vocational Education.

Note: No cost information available.

[redacted]

DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: United Systems Testing
(Operated in) St. Louis, MO

2. Contact Name and Number: John Noettle
(602) 869-9331

3. General Description of Facility: In March of 1978, Senate hearings were held by the Consumer Subcommittee of the Senate Committee on Commerce, Science and Transportation. During those hearings, various comments inspired the concept of a mobile diagnostic inspection and repair service for company employees as an employee benefit. In response to those hearings, United Systems Testing, Inc. was formed by John Noettle and began operating in the St. Louis metropolitan area in July, 1978.

The objectives of the Mobile Vehicle Inspection/Repair Program were the following:

- To eliminate, wherever possible, the inconvenience associated with vehicle diagnosis and repair.
- To do a thorough diagnosis, so that only necessary repair work need be performed.
- To communicate the condition of the vehicle to the owner in such detail that he or she would be fully aware of all alternatives in terms of cost and time that are available in making decisions about repair work.*

The repair work that was performed by UST was generally "light repair" (i.e. no transmission work, engine overhaul, etc.). UST was able to perform 85 percent of the work people wanted done, including tune-ups, brakes and pumps.

UST stopped performing inspection/repairs in December of 1979. The diagnostic van subsequently was sold to the U.S. Environmental Protection Agency.

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* "The Design, Implementation, and Operation of a Mobile Diagnostic Inspection System in the Metropolitan St. Louis Area," by John Noettle. Report to Department of Transportation (National Highway Safety Traffic Administration). Page 3. See also, "Mobile Diagnostic Inspection of Motor Vehicles," NHTSA Technical Report, DOT-HS-805-514, June, 1980.

4. Vehicle Types Inspected: All American and foreign vehicles up to two-ton trucks.

5. Types of Inspection Services: The organization offered five testing/inspection/repair concepts:

   - Employee Car Care Program (ECCP). This concept offered vehicle diagnostic inspections and repair to company employees' vehicles on the company parking lot. The program was sold to companies as an employee benefit.

   - Fleet Maintenance Program (FMP). This concept was designed to assist a company in the management and maintenance of vehicle fleets. The system provided for a company's fleet to be inspected and repaired at a time most convenient for the company.

   - Individual Vehicle Inspection and Maintenance (IVIM). This concept provided an individual with vehicle inspection and maintenance on an individual basis at the owner's residence or place of employment.

   - Garage Bay Utilization. In this concept the mobile vehicle was employed to assist oil company-owned gas station chains to increase their bay utilization and expand the concept of the neighborhood repair facility.

   - Vehicle Leasing Companies. The mobile vehicle concept also included providing service to vehicle leasing companies.

6. Operating Hours: Flexible to suit customer's needs. Was not uncommon to work nights, Saturdays, or Sundays.

7. Physical Area of Inspection Facility: Not applicable.

8. Inspection Station Dimensions: 26' long GMC Transmode Van purchased in 1978. Supplemented by Dodge Maxi Van.

9. Number of Lanes/Bays: Not applicable.

10. Lane/Bay Dimensions: Not applicable.

11. Queueing Area: Not required.

12. Parking Area: The space needed for van, vehicle being serviced, and inspection work area was provided by the customer.

13. Facility Diagram and Location of Equipment: See Figure 1.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: Vehicle and equipment were purchased in 1978.

2. Construction Type and Material: Steel shelled motorvan.

3. Patron Accommodations: Waiting area in "office" of the GMC van.

4. Ventilation System Design: None.

5. Safety Accommodations: Normal safety procedures are followed.

6. Noise Accommodations: None.

III. STEPS OF INSPECTION PROCESS

1. Check-In: Administrative, check-in and general procedures for the Employee Car CareProgram are shown in Table 1.

2. Test Sequence:

   - Visual inspection for safety items including the horn, windshield and mirror.

   - Check lights, brakes (limited road test), transmission. Underhood check of air conditioning, pollution control systems, fan, fluid levels, hoses.

   - Engine Analysis, check charging/starting systems, idle, dwell, timing.

   - Chassis inspection, check ball joints, brakes, (wheel pull on jack stand), linkage, wheels.

   Full Test Sequence is listed in Figure 2.

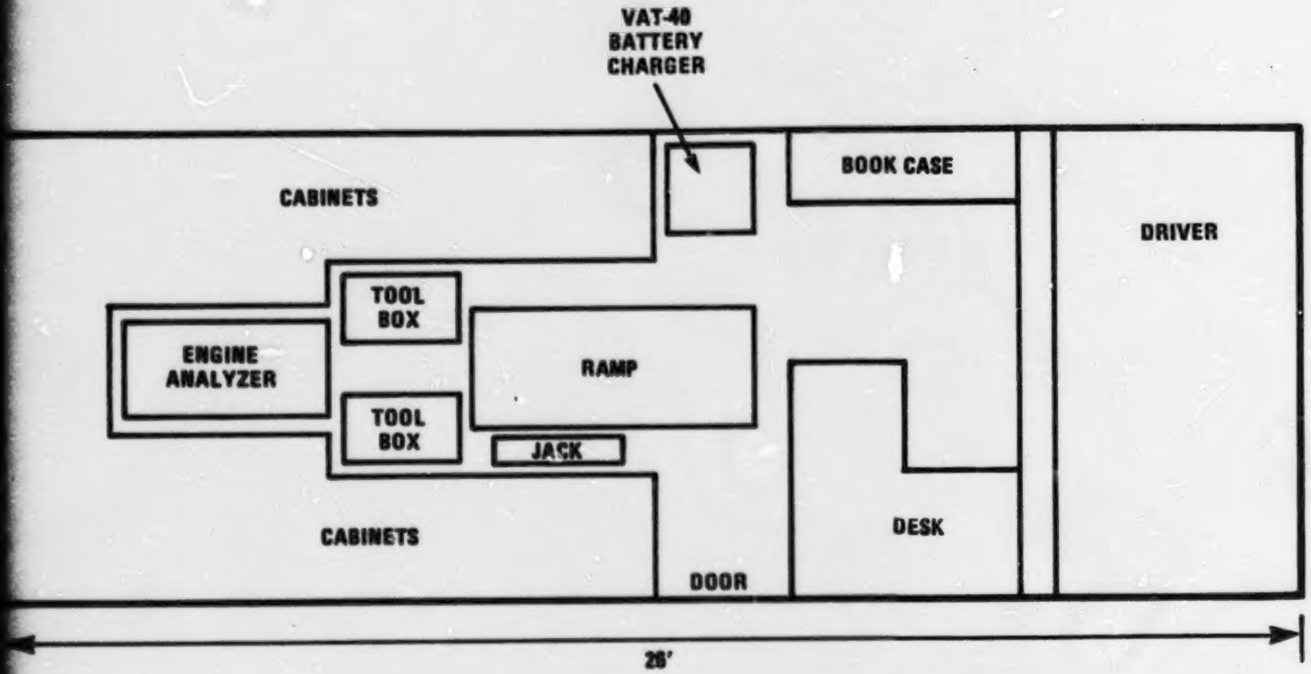
VAT-40
BATTERY
CHARGER
BOOK CASE
CABINETS
DRIVER
TOOL
BOX
ENGINE
ANALYZER
RAMP
TOOL
BOX
JACK
CABINETS
DESK
DOOR
26'

FIGURE 1. GMC TRANSMODE LAYOUT

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TABLE 1. UST ECCP INSPECTION/REPAIR GENERAL PROCEDURES

1. Contract signed with company client.
2. Date UST will be at company announced by personnel department.
3. UST ECCP inspection request forms available at personnel department.
4. Employees fill out UST ECCP inspection request appointment forms and leave at personnel department with keys on the day they want their car inspected.
5. Forms are filed with keys in order received at UST special file bin.
6. UST records clerk picks up file bin.
7. Teams obtain cars in order filed in UST file bin.
8. Inspection procedure followed by inspectors/mechanics.
9. Inspectors transmit inspection results and repair instructions to UST records clerk.
10. Records clerk enters data on forms.
11. After each section on inspection forms, inspector dictates repair instructions. Repair cost estimates are given upon request.
12. Records clerk enters repair instructions and repair cost estimate on inspection form.
13. Two copies of inspection forms made and given to inspector.
14. Inspector places original in employee's car and returns keys to records clerk.
15. Records clerk places keys and notice of inspection completion in UST file bin.
16. File bin is returned to the personnel department.
17. Records are taken to the UST control center.
18. Employee authorizes repairs and takes form to personnel department.
19. Personnel department files repair authorization in UST file bin in order of receipt.
20. UST records clerk obtains file bin from personnel department.
21. Mechanic performs repairs.
22. Repair bill is given to file clerk with keys.
23. Employee pays file clerk for repairs and obtains keys.

UST VEHICLE INSPECTION PROCEDURES
OPERATOR EQUIPMENT

Upon approaching the vehicle visually inspect exterior to determine if any damage is present. If damage is present, document before entering vehicle. Start vehicle and while proceeding to inspection area check the following:

100. Horn.

101. Windshield Check windshield for cracks or crazing.

102. Mirrors. Check all mirrors. Check for tightness and adjustability.

103. Windshield Wiper System. Check for operation and streaking. Check condition of wiper blades--check blade-to-glass contact.

104. Windshield Washer System. Check operation and aim.

While driving to the inspection area, mentally note any obvious outages such as: engine running rough; steering very loose; etc. After arriving at the inspection station check the remaining operator equipment:

105-112. Lights. With mirrors properly positioned, check operation of high and low beams, parking lights, front turn signals, and operation of four-way flashers in the front, operation of tail lights, brake lights, rear turn signals, and four-way flasher operation in the rear. Check corner illuminators and side markers if visible in the mirrors. Check license light.

113. Service Brake. While driving to inspection site, check pedal height--apply brakes from 30 mph--check for any pulling or brake grabbing. Listen for any unusual noises.

114. Parking Brake. Check operation of parking brake actuating lever and release mechanism. Check brake for complete engagement.

115. Neutral Safety Switch. Check to insure that automatic shift vehicle starts only in park and neutral, standard transmission starts only in neutral.

FIGURE 2. UST INSPECTION SEQUENCE

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116. Defroster/Heater/Air Conditi [illegible] Check operation of blower. Check all modes c [illegible] ter switch. Release hood latch if internally located. Check any lights that were inaccessible from mirrors.

117. Seat Belts. Check the condition of seat belts for fraying, retractor operation, broken or missing comfort adjustment.

200. Hood Latch. Check primary and secondary hood latch for lubrication and adjustment and hood hinges for lubrication.

201.
202.
203. Fluids. Check engine oil level and contamination. Check power steering fluid level, check brake fluid level. Check all fluids for contamination.

204. Washer Reservoir. Check windshield washer reservoir level.

205.
206. Battery. Check water level, check clamps and cables, and check hold down. Check and record hydrometer reading.

207. Accessory Drive Belts. Check tension and condition.

208. Air Injection System. Visually check air pump, inspect fan filter with engine running. listen for air escaping. If air is escaping replace diverter valve. Remove air hose from the check valve inlet tube. If exhaust air escapes from the inlet tube, replace check valve. Inspect injection tubing and joints for leaks.

209. Evaporative Control System. Check the carbon cannister, carbon cannister filter, hose running to ventura vacuum and hose running to the liquid seperator. Check vapor vent lines, gas filler neck and gas cap.

210. Exhaust Gas Recirculation. With engine at operating temperature and running at idle, apply at least 9 inches of vacuum to the EGR valve and observe the engine rpm's. The rpm's should drop 100 - 250 rpm's. With the engine stopped, apply 10 inches of vacuum to the valve. The valve should hold vacuum for 30 seconds.

212. Air Cleaner System. Remove air filter element and tap the filter several times on a hard surface. If excessive dirt falls from the filter recommend replacement. Hold a light behind the filter element. If the element is oil soaked or light will not pass through the element recommend replacement. Check PCV filter. If filter appears very dirty recommend replacement. Remove the air cleaner

FIGURE 2. (CONTINUED) UST INSPECTION SEQUENCE LIST

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housing. Before the housing is placed back in position, observe the flapper valve in the snorkle. If the ambient temperature is under 85 degrees, the flapper valve should be in the heated air position. After re-installing the air cleaner, allow the engine to idle and observe the flapper valve. The flapper valve should move up to the under hood air position. The vacuum motor can be checked using a hand vacuum pump while observing the flapper door. The door should operate smoothly.

213. Carburetor/Fuel System. With the air cleaner housing removed look down into the primary bores and actuate the accelerator the full length of its travel. Fuel should continue to spurt out for a second or two after accelerator is in the wide open throttle position. Inspect all linkage for free movement, inspect the choke valve for free movement, inspect the throttle shaft for excessive play, check carburetor mountings and carburetor body screws for tightness.

214. Fan. Check condition of fan blades, check thermostatic clutch if so equipped.

215. Water Pump. Check for loose shaft, check for coolant leaks around the shaft.

216. Hoses. Check upper and lower radiator hoses. Check heater hoses, check water pump by-pass hose, check vacuum hoses, check windshield washer hoses. Pressure check radiator and cooling system.

217. Coolant Strength. Check the hydrometer and record coolant strength.

218. Air Conditioning System. With air conditioning on and blower in the high position, observe the sight glass for bubbles.

219. Automatic Transmission Oil. Check automatic transmission fluid level.

Engine Analysis Section

Connect all engine analyzer leads and connect starting charging system tester carbon pile leads only.

300. Starting System. Depress engine kill switch (on HEI equipped vehicles, disconnect battery lead from the distributor). Crank engine for about 10 seconds and observe and record amp draw and battery voltage.

FIGURE 2. (CONTINUED) UST INSPECTION PROCEDURE

[redacted]

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301. Charging System. Enable ignition system, start the engine and run at 2500 rpm. Adjust the carbon pile resistor until battery voltage reads 12 volts. Record amp reading, turn carbon pile resistor off. When voltage stabilizes, record charging voltage.

302. PCV Valve. Close off PCV valve hose and observe idle rpm drop. Idle speed should drop about 50 rpm's. Observe vacuum drop at least 1 inch and CO reading. CO should increase 1-3 percent.

303-313. Set up the engine analyzer in the following manner: pattern position switch to CONV. Adjust vertical trace to zero line. Put cylinder selector switch to 8 cylinder position and adjust horizontal trace and length. Set function selector to secondary set pattern heighth to high, set pattern selector to display, select 2 or 4 cycle as applicable. Set ignition selector knob to number 1 position except as follows: BTI and BID systems, number 2 position; passive discharge systems, number 4 position. Set number of cylinders knob to number of cylinder engine being tested. Volt ohm knob to 20 V position. Calibrate HC and CO meters, HC at 400 ppn and CO at 2 percent.

Be sure engine is warmed up until choke is fully opened. Read and record idle rpm, dwell (if applicable), check and record initial timing (hoses disconnected as applicable). Read and record CO and HC, mentally note engine manifold vacuum. Increase engine rpm to 1200 rpm. Observe coil pullarity, observe and record spark plug required firing voltage. Remove a high tension lead at an available spark plug, pull away from ground and observe maximum coil output. Observe secondary insulation condition below the zero line. Note any outages, move the control knob to raster position, note any outages such as: excessive secondary resistance; abnormal plug firing lines, coil and condensor condition; point condition in the open and closed position. Move to superimpose and check cam lobe accuracy. Observe CO and HC reading. Perform cylinder balance test and record results. At this time a particular problem has been observed. Short out one back of cylinders at a time and short out one feeder runner from the intake manifold at a time.

NOTE: If vehicle is equipped with floor jet EGR, cylinder balance test cannot be performed.

Quickly snap accelerator them release while observing spark plug firing lines in the dispaly position. Note action of accelerator pump on CO meter.

FIGURE 2. (CONTINUED) UST INSPECTION SEQUENCE

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Increase rpm to 2500. Check timing advance, observe dwell and metnally note any change (except electronic ignition). Observe charging voltage, observe CO and HC observe engine manifold vacuum. Be alert for drop in vacuum that would indicate restricted exhaust system. Disconnect analyzer leads, reinstall air cleaner, connect all vacuum hoses, close vehicle hood.

400-505. Position jack centered under front cross member and lift vehicle high enough to position jack stand beneath left lower controller. Lower vehicle on the jack stand to unload ball joint, pry up on tire using press bar and note excessive movement in ball joints. If there is clearance but it does not appear excessive, attach ball joing gauge and record outage. Grab tire at twelve o'clock and six o'clock position and move tire toward and away from you. Observe any movement in ball joints. Grasp wheel at three and nine o'clock position and move wheel about 2 inches in each direction while ovserving each steering joint for excessive play. Raise jack, unload right ball joint and repeat ball joint checking procedure.

Raise vehicle from right side palcing the jack under the frame midway between front and rear wheels. Position jack stand under frame as close as possible to the front and the rear wheels. Lower vehicle onto jack stands.

DISC BRAKES: Remove wheel plugs, remove wheel assembly and ovserve condition of brake pads. Note any uneven wear and lining thickness. Reject if less than 5/32 at lowest point. Check rotor for scoring and obvious out of round condition. Check caliber for secure mounting and fluid leak. Check flexible hose for condition. Reinstall wheel assembly.

DRUM BRAKES: Remove dust cover, remove cotter pin, remove nut, remove washer, remove outer bearing, remove wheel assembiy. Check lining thickness, reject if less than 3/32 bonded or 1/16 riveted. Check wheel cylinder for leaks and contamination. Check self adjusting mechanism. Check parking brake linkage, reinstall wheel and tire.

Measure tire tread depth at the thinnest point. Note tire construction and tire pressure. Examine each exhaust system joint and component for signs of leakage, holes, dents that could cause restriction, secure mounting, and proper tail pipe position. Check for engine oil leaks, transmission oil leaks and fuel lines from tank to pump and cannister.

FIGURE 2. (CONTINUED) UST INSPECTION SEQUENCE

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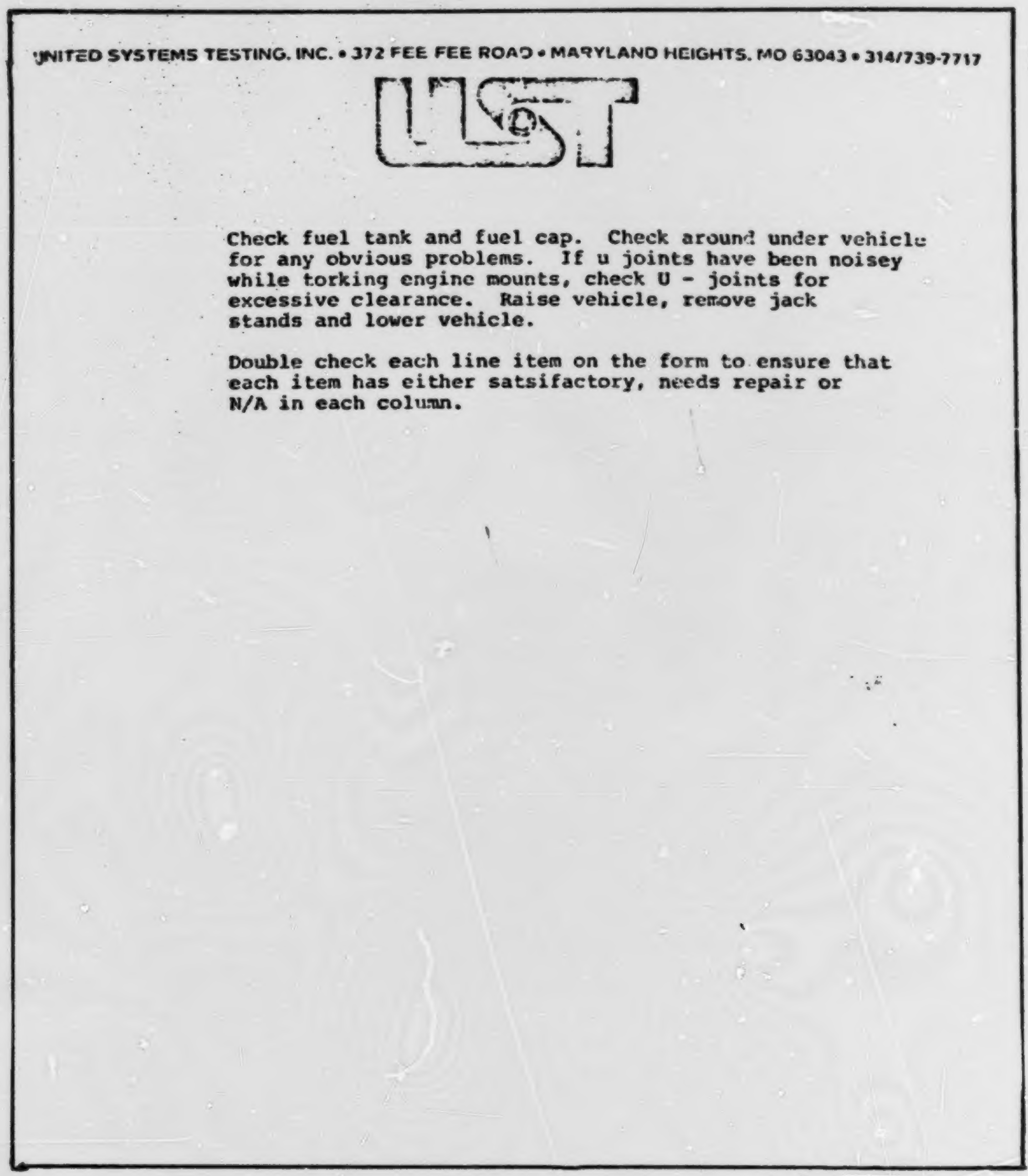

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Check fuel tank and fuel cap. Check around under vehicle for any obvious problems. If u joints have been noisey while torking engine mounts, check U - joints for excessive clearance. Raise vehicle, remove jack stands and lower vehicle.

Double check each line item on the form to ensure that each item has either satsifactory, needs repair or N/A in each column.

FIGURE 2. (CONTINUED UST INSPECTION SEQUENCE

3. Data Handling: Customer fills out Inspection Application form which authorized UST to inspect vehicle (See Figure 3). Diagnosticians inspected vehicle while records clerk records data on inspection form (See Figure 4). After each section on inspection forms, inspector dictates repair instructions to records clerk. Records clerk enters repair instructions on repair Cost Estimate and Work Authorization form (See Figure 5).

4. Check-Out: The diagnostician provided a checksheet and an estimate of repairs.(See Figures 4 and 5). Customer consultations were available but not required.

5. Comments:

   - Equipment was unloaded from the GMC van in approximately five minutes and loaded in seven minutes.* (For inspecting a small number of vehicles, the Dodge Maxi-Van was used. Here the equipment, including the analyzer, remained on the van.)

   - The equipment was moved in and out of the van on a ramp from the side door. In addition, there was an 8-foot awning on the side of the van for protecting the test equipment during showers and from the sun.

   - Two vehicles would be inspected in parallel by a two-man team. Where required, the two mechanics would assist each other on the inspection; otherwise each mechanic would inspect a single vehicle. (400 items.)

VI. FEES

1. Diagnostic Inspection: Full Inspection - $35.00.

2. Other Services: Engine diagnostic, emissions check and tune up - $15.00; Engine analysis and winter inspection - $20.00; Special troubleshooting - $10.00/hour.

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* If plenty of space was available. The GMC van was hard to maneuver at small garages and parking lots.

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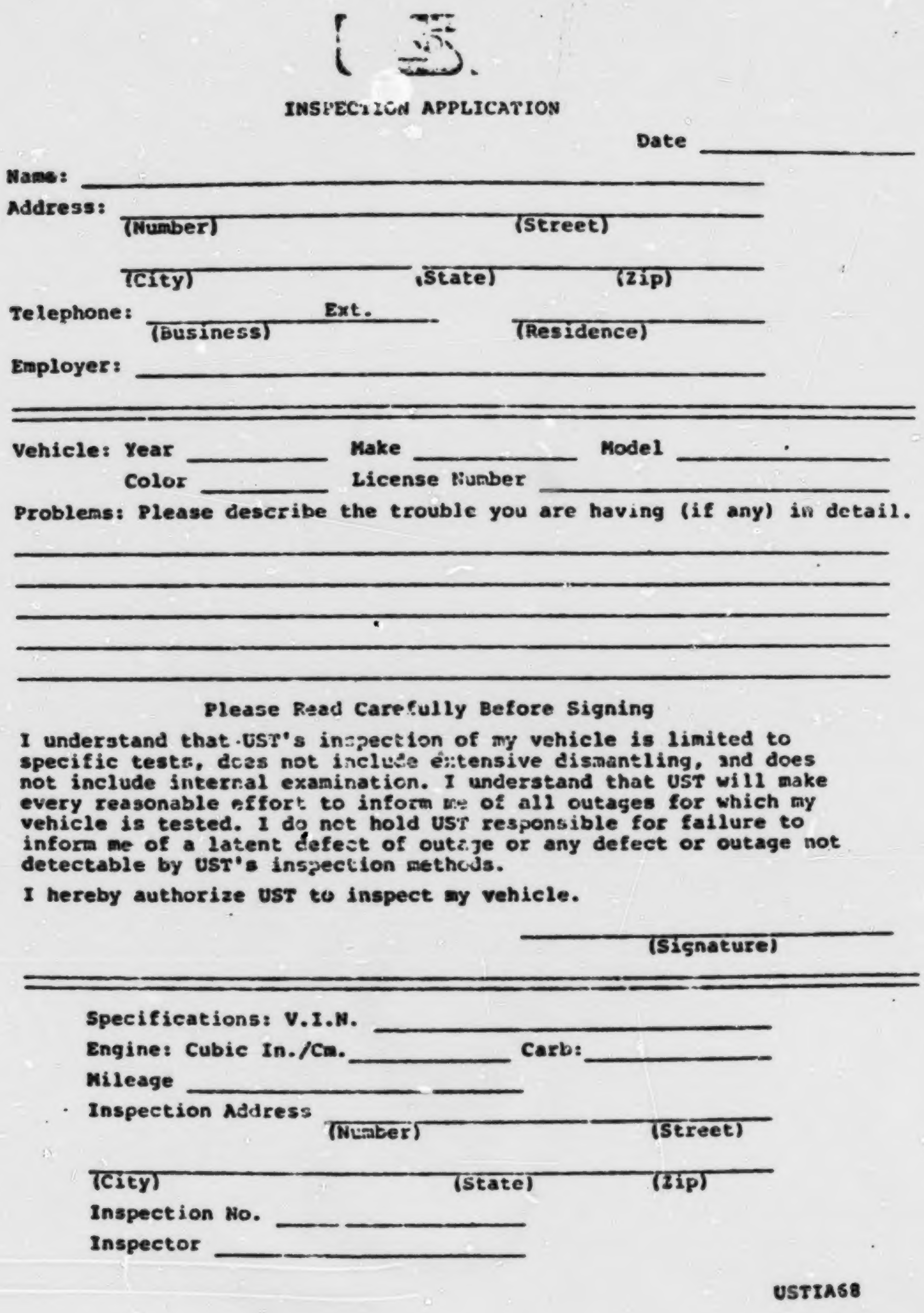

INSPECTION APPLICATION

Date ____________

Name: ______________________________

Address: ______________________________
(Number) (Street)

____
(City) (State) (Zip)

Telephone: ____________ Ext. ______ ____________
(Business) (Residence)

Employer: ______________________________

Vehicle: Year ________ Make ________ Model ________

Color ________ License Number ____________

Problems: Please describe the trouble you are having (if any) in detail.

____

____

____

____

____

Please Read Carefully Before Signing

I understand that UST's inspection of my vehicle is limited to specific tests, does not include extensive dismantling, and does not include internal examination. I understand that UST will make every reasonable effort to inform me of all outages for which my vehicle is tested. I do not hold UST responsible for failure to inform me of a latent defect of outage or any defect or outage not detectable by UST's inspection methods.

I hereby authorize UST to inspect my vehicle.

____
(Signature)

Specifications: V.I.N. ____________________

Engine: Cubic In./Cm. ________ Carb: ________

Mileage ____________

Inspection Address ______________________________
(Number) (Street)

____
(City) (State) (Zip)

Inspection No. ____________

Inspector ____________

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FIGURE 3. UST INSPECTION APPLICATION

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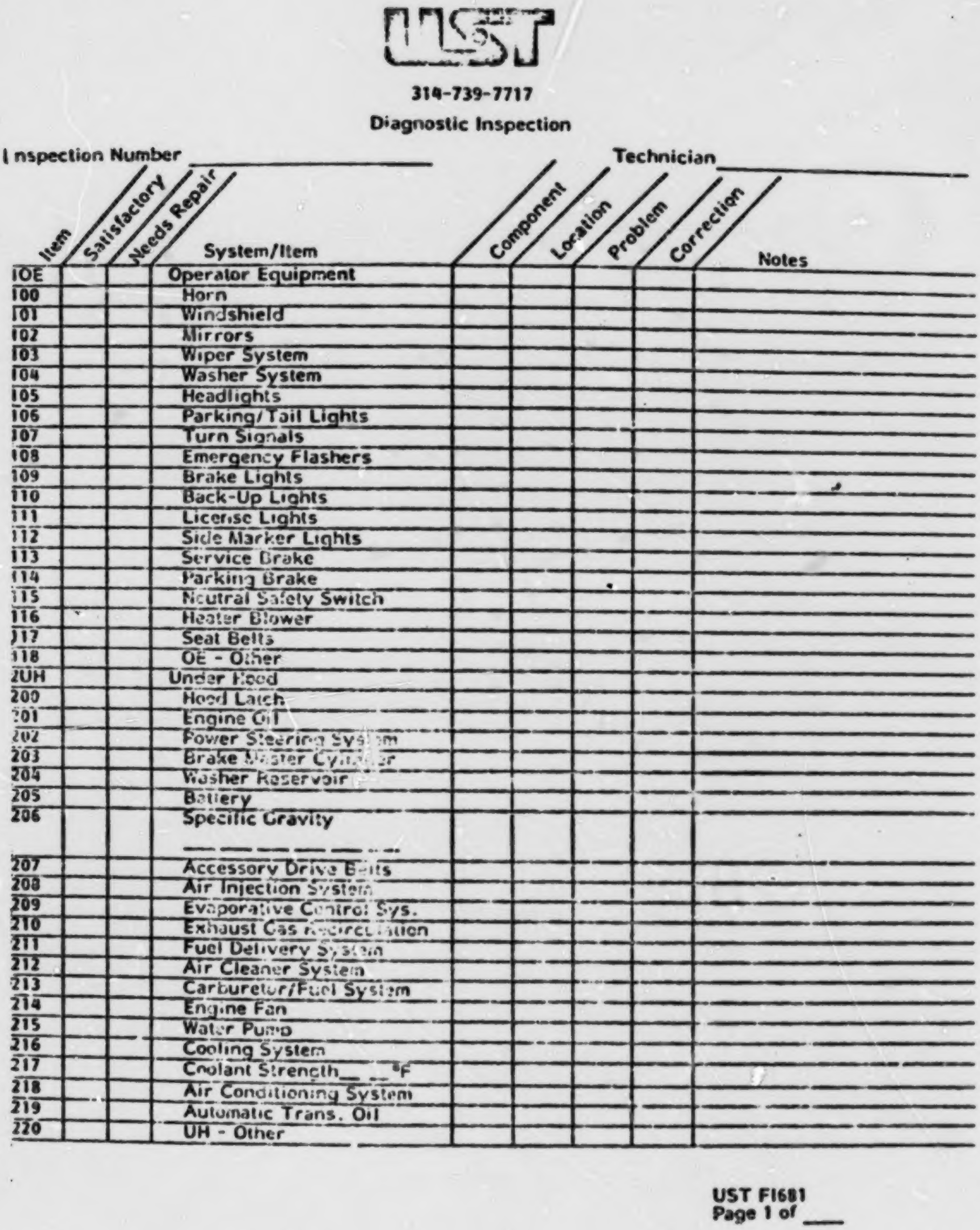

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Diagnostic Inspection

Inspection Number ____________________ Technician ____________________

Item	Satisfactory	Needs Repair	System/Item	Component	Location	Problem	Correction	Notes
IOE			**Operator Equipment**					
100			Horn					
101			Windshield					
102			Mirrors					
103			Wiper System					
104			Washer System					
105			Headlights					
106			Parking/Tail Lights					
107			Turn Signals					
108			Emergency Flashers					
109			Brake Lights					
110			Back-Up Lights					
111			License Lights					
112			Side Marker Lights					
113			Service Brake					
114			Parking Brake					
115			Neutral Safety Switch					
116			Heater Blower					
117			Seat Belts					
118			OE - Other					
2UH			**Under Hood**					
200			Hood Latch					
201			Engine Oil					
202			Power Steering System					
203			Brake Master Cylinder					
204			Washer Reservoir					
205			Battery					
206			Specific Gravity __ __ __ __ __ __					
207			Accessory Drive Belts					
208			Air Injection System					
209			Evaporative Control Sys.					
210			Exhaust Gas Recirculation					
211			Fuel Delivery System					
212			Air Cleaner System					
213			Carburetor/Fuel System					
214			Engine Fan					
215			Water Pump					
216			Cooling System					
217			Coolant Strength__ __°F					
218			Air Conditioning System					
219			Automatic Trans. Oil					
220			UH - Other					

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FIGURE 4. UST DIAGNOSTIC INSPECTION FORM

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-739-7717

Diagnostic Inspection (Cont.)

				Needed Repairs				
Item	Satisfactory	Needs Repair	System/Item	Component	Location	Problem	Correction	Notes
3EA			Engine Analysis					
300			Starting System __ __ __ Amps. at . Volts					
301			Charging System __ __ __ Amps at __ __.__ Volts					
302			P.C.V. Valve					
303			Idle__ __ __ __RPM					
304			Dwell________°					
305			Initial Timing_____°BA					
306			Timing Advance at 2500 RPM_____°					
307			Carbon Monoxide __ __%					
308			Hydrocarbons__ __ __PPM					
309			Required Firing Voltage __ __ __ __ __ __ __ __KV					
310			Cylinder Balance RPM Drop __ __ __ __ __ __ __ __					
311			Primary Ignition System					
312			Secondary Ignition System					
313			Distributor					
314			EA - Other					
4ST			Steering, Susp., Brakes, Tires					
400			Wheel Brake System					
401			__ __ Wheel Bearing					
402			__ __ Drum/Rotor					
403			__ __ *Lining/Pad Riv Bd					
404			__ __ Wheel Cyl/Caliper					
405			__ __ Adj Mechanism					
406			Tires RF RR LF LR Tread Depth* __ __ __ __ Type __ __ __ __ Pressure __ __ __ __ Balance __ __ __ __					
407			Steering System					
408			Front Suspension					
409			Rear Suspension					
410			ST - Other					
5UV			Under Vehicle					
500			Exhaust System					
501			Brake Hoses					
502			Engine Mounts					
503			Engine Oil Leaks					
504			Trans. Oil Leaks					
505			Fuel Tank					
506			UV - Other					

* measured in 32nd of inch

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FIGURE 4. UST DIAGNOSTIC INSPECTION FORM (CONTINUED)

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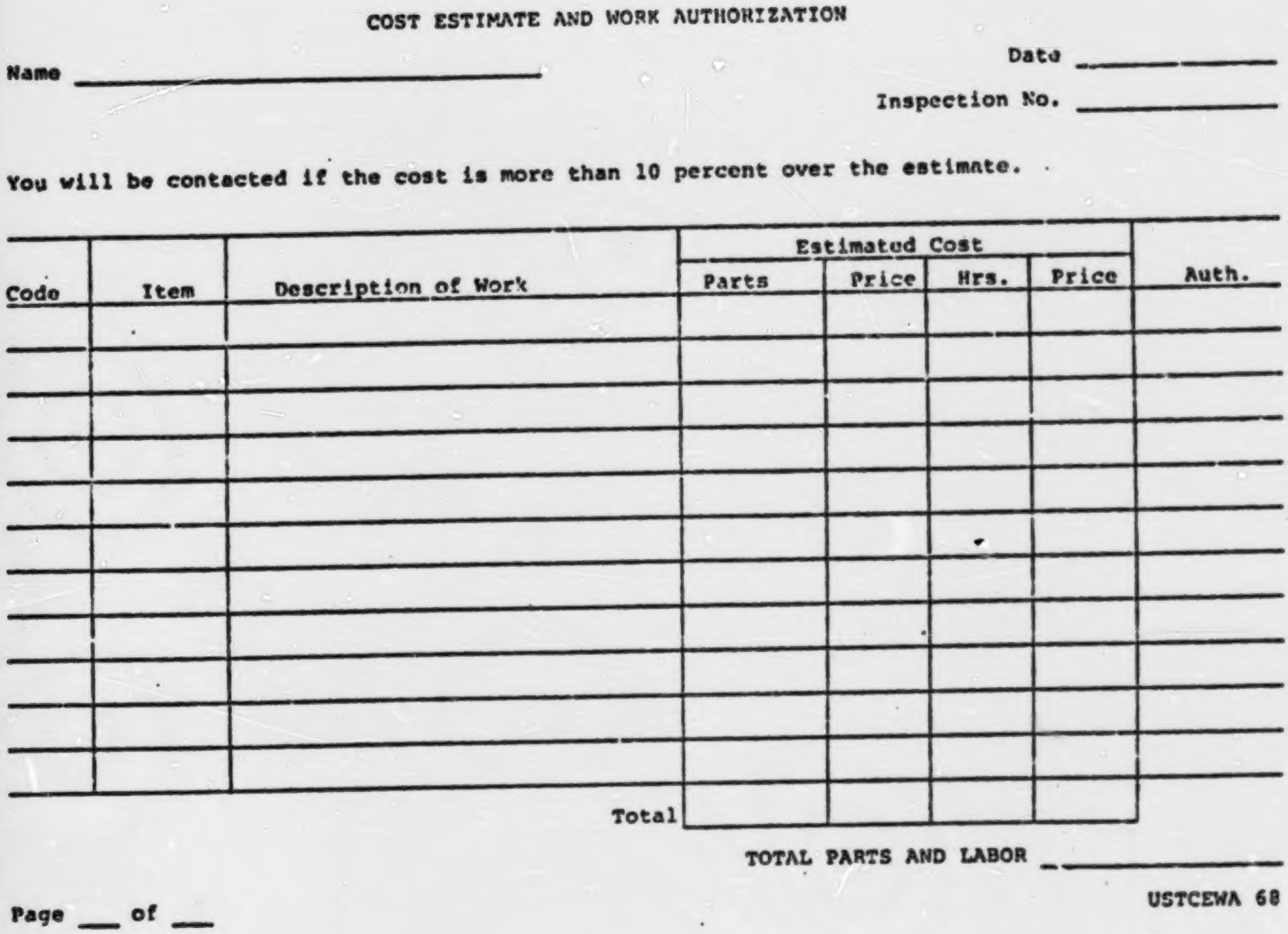

COST ESTIMATE AND WORK AUTHORIZATION

Name ______________________

Date ____________

Inspection No. ____________

You will be contacted if the cost is more than 10 percent over the estimate.

Code	Item	Description of Work	Estimated Cost				Auth.
			Parts	Price	Hrs.	Price	
		Total					

TOTAL PARTS AND LABOR ____________

Page ___ of ___

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FIGURE 5. UST COST ESTIMATE AND WORK AUTHORIZATION

V. TEST EQUIPMENT

1. Brakes: Micrometer.

2. Alignment: None.

3. Headlight Aimer: None.

4. Lift: None.

5. & 6. Emissions/Engine Analyzer: Sun 1115 ($6,495).

7. Dynamometer: None.

8. Noise Testing: None.

9. Fuel Economy: None.

10. Other: Sun VAT-40 Starting/Charging System ($745).
Sun BC-160 Battery Charger ($380).
Walker Hydraulic Jack ($276.45).

11. Plans for Replacement: None.

12. Technical Library: Shop manuals for most foreign and domestic automobiles and light trucks, and a small library of about 50 books on various diagnostic and repair procedures were placed in the library on board the mobile vehicle.

13. Mobile Equipment: UST is a mobile unit inspection and service unit.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Maintenance. As need was determined by the station manager.

2. Frequency of Gas Calibration for Emission Analyzer: Every 3-4 weeks.

VII. FACILITY STAFFING

1. Program Director: None.

2. Station Manager: One automotive engineer.

3. Master Mechanics: Two full-time mechanics.

4. Junior Mechanics: None.

5. Diagnosticians: None.

6. Aides: None.

7. Clerical: Three part-time typists/records clerks, one part-time receptionist.

8. Other: None.

VIII. TRAINING

1. Inspector* Experience Requirements: Inspectors were experienced and certified NIASE mechanics who may have operated repair facilities previously.

2. Employee Training Provisions: Minimal due to experience.

3. Technical Update Meetings: None.

IX. QUALITY CONTROL

1. Supervision for Inspectors: The station manager supervised inspectors.*

2. Surveys of Customer Satisfaction: None.

3. Criteria for Failure: Components were rated "satisfactory" or "needs repair" according to the inspectors' judgment and/or the specifications of technical references.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

None.

XI. CUSTOMER INTERFACE

1. Counseling: Provided but not required. A number of ECCP clients made inquiries about the inspection results.

2. Additional Customer Services: None.

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* All inspections were performed by master mechanics.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: 35-45 minutes
2. Time at Each Station: Not applicable.
3. Theoretical Maximum Throughput: 23-30 vehicles/day with a third mechanics.
4. Average Lane Throughput: 10 vehicles per day.
5. Appointments Used: Yes.
6. Busiest Time of Year: Not applicable since project was short term.
7. Maximum Number of Vehicles Processed for the Entire Facility: 25/30 vehicles per day.

XIII. CONSUMER AND COMMUNITY RELATIONS

None

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment: See Table 2.
2. Current Average Hourly Labor Rate: UST discontinued operations in December 1979. Hourly labor rates are not available.
3. Building and Land Costs: Not applicable.
4. Utilities: Not applicable.
5. Labor Costs: UST personnel were paid salaries higher than area average, due to experimental nature of the operations. Labor costs for three full-time and four part-time persons were approximately $10,000/month.

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TABLE 2. MAJOR EQUIPMENT COSTS*

GMC Transmode (26-foot)	$28,000
Modification Cost (Transmode)	4,000
Dodge Maxi Van	6,000
Modification Cost (Maxi Van)	300
Generator (Maxi Van)	750
SUN 1115 Analyzer	6,500
Starting and Charging System Tester VAT-40	750
SUN BC-160 Battery Charger	400
Walker Model 93632 Hydraulic Jack	300
Tool Boxes (2)	800
Mechanic's Tools	2,500
Pressure Testers	300
Hydrometers	100
Mitchell Manuals - Domestic cars, foreign cars, and light trucks	500
Total (approximate)	$51,200

* 1978 Costs.

APPENDIX C

DIAGNOSTIC DEMONSTRATION PROJECT CHARACTERISTICS AND EFFECTIVENESS SUMMARIES

	Page Number
Huntsville, Alabama	C-1
Tuscon, Arizona	C-17
Washington, D.C.	C-31
Puerto Rico	C-45
Chattanooga, Tennessee	C-61

DIAGNOSTIC DEMONSTRATION PROJECT
CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: Auto Check - Alabama Motor
Vehicle Diagnostic Inspection
Demonstration Project
Huntsville Campus
University of Alabama

2. Contact Name and Number: Dr. Bernard Schroer
205 - 895-6361

3. General Description of Facility: A vehicle diagnostic inspection demonstration, sponsored by NHTSA,* was conducted by the University of Alabama with the technical support of the Chrysler Corporation. The demonstration conducted inspections from February 28, 1975 to June 30, 1976. Until October 1975, these inspections were conducted in a temporary facility while the permanent facility was being built. The demonstration was given to two volunteer groups: the treatment group and the control group. Both groups received the same inspection.** They did not, however, receive the same information, thereby creating two levels of information: the treatment group received all the inspection data, while the control group received condensed (simplified) data. Participants returning for an after-repair inspection were counseled on the quality of the repair.

The demonstration was conducted to permit three cycles of voluntary participation. The number of participants in the three cycles were:

- First cycle - 7,718 in the treatment group and 7,751 in the control group (first cycle participants were acquired throughout the program)
- Second cycle - 1,822 in the treatment group and 1,839 in the control group
- Third cycle (restricted by time) - 182 in the treatment group and 123 in the control group.

---

* Also sponsored by the State of Alabama; each state contributed at least 10 percent matching funds, per the Act, though it did not have to be directly in cash.

** But only the treatment group received engine analysis following a failed HC emissions inspection.

The demonstration was conducted in a lane configuration to demonstrate the feasibility of a high-throughput vehicle diagnostic system. The facility contained three lanes of diagnostic inspection which branched into six hoist stations. This design was conceived to optimize throughput by eliminating a bottleneck in inspection flow at the hoists. The diagnostic inspection included loaded mode emissions testing, wheel alignment testing, dynamic brake testing using a dynamometer, instrumented testing of headlamp aim, and visual inspection of underhood, undercarriage, interior and exterior subsystems and components. In the event of HC emissions test failure, an engine ignition system analysis was conducted in a bay area (treatment group only).

4. Vehicle Types Inspected: The vehicles inspected were all passenger vehicles in different weight classes. The vehicles included all United States manufacturers (American Motors, Chrysler, Ford, General Motors products) and imports (Datsun, Toyota, Volkswagen).

5. Types of Inspection Services: Inspections included:

- Brakes - roller brake testing using a brake dynamometer, visual inspection of brake components by pulling two wheels
- Exhaust emissions - loaded mode testing for HC and CO levels, condition of exhaust system and components
- Wheel alignment - automated instrument dynamic reading of caster, camber, and toe angles
- Steering/suspension - visual inspection of ball joints, tie rods, shock absorbers, springs, and energy absorbing steering column
- Tires and wheels - visual inspection of condition of wheels and tires
- Interior - visual inspection of seats, head restraints, rear view mirror, horn, windshield wipers and washer, speedometer, transmission shift lever and indicator, defroster/defogger
- Lights - Headlamp aim inspection by instrument, and visual inspection of directional signals,

brake lights, stop lamps, reverse lights and side marking lights

- Body/chassis - visual inspection of frame, bumpers, doors, fenders, glazing, outside mirror, hood, latches and locks, gas filler cap

- If failed HC emissions - engine ignition systems analysis (treatment group only).

6. Hours of Operation: 8:15 to 4:45 - Monday through Friday.

7. Physical Area of Inspection Facility: The facility, located on a corner of the Huntsville campus of the University of Alabama, covered approximately 14,500 square feet. This area included under one roof the inspection lanes, a large bay area, a customer waiting room and counseling area, a participant education area, utility and storage space, and staff offices and lounge. The facility was located on a 200' x 350' (70,000 square feet) lot.

8. Inspection Station Dimensions: The lane inspection area approximated 7,000 square feet. It was truncated to accommodate a branching of three lanes to six lift stations. The engine diagnostic bay area was approximately 24' x 22' (528 square feet).

9. Number of Lanes/Bays:

   - Lanes - three, branching to 6 lifts

   - Bay - one.

10. Lane/Bay Dimensions:

    - Lanes - 18 feet wide at entrance (expanding to 25 feet wide to accommodate two lifts for each lane) by 110 feet long

    - Bay - approximately 24' x 22'.

11. Queueing Area: The vehicles waited in line while being assigned by an attendant outside of each of the three lanes. As many as a total of six cars waited at one time. The participant was assigned a parking space during the counseling session.

12. Parking Area: There were 20 parking spaces out of 50 made available to participants. The rest were intended for employees.

13. Facility Diagram and Location of Equipment: Figure 1 illustrates the dimensions of the facility and the location of the major diagnostic inspection equipment.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: The permanent diagnostic facility was constructed in 1975. It was made available for inspection October 1975.

2. Construction Type: The facility was housed in a one-story building which fit the decor of the campus. The building was a metal structure enclosed in brick.

3. Patron Accommodations: Motorist reception areas included waiting rooms, rest rooms, counselor cubicles and a mini-theater containing wall displays of the inspection process and give-away packets of mimeograph material explaining the Title III inspection programs and process.

4. Health/Safety/Noise Accommodations: The area containing the engine dynamometer, where noise and pollution would be highest, was located at the facility entrance to direct noise and pollution out of the building.

III. STEPS OF INSPECTION PROCESS

1. Check In:
    - Motorist received sequence number and direction for inspection
    - Provided sequence number to the receptionist and waited in the waiting room for the inspection to be completed
    - Motorist could view available display or watch slide show in participant education area.

2. Test Sequence:
    - Station 0 - tires; exterior (glass and body) inspection; exterior inspection

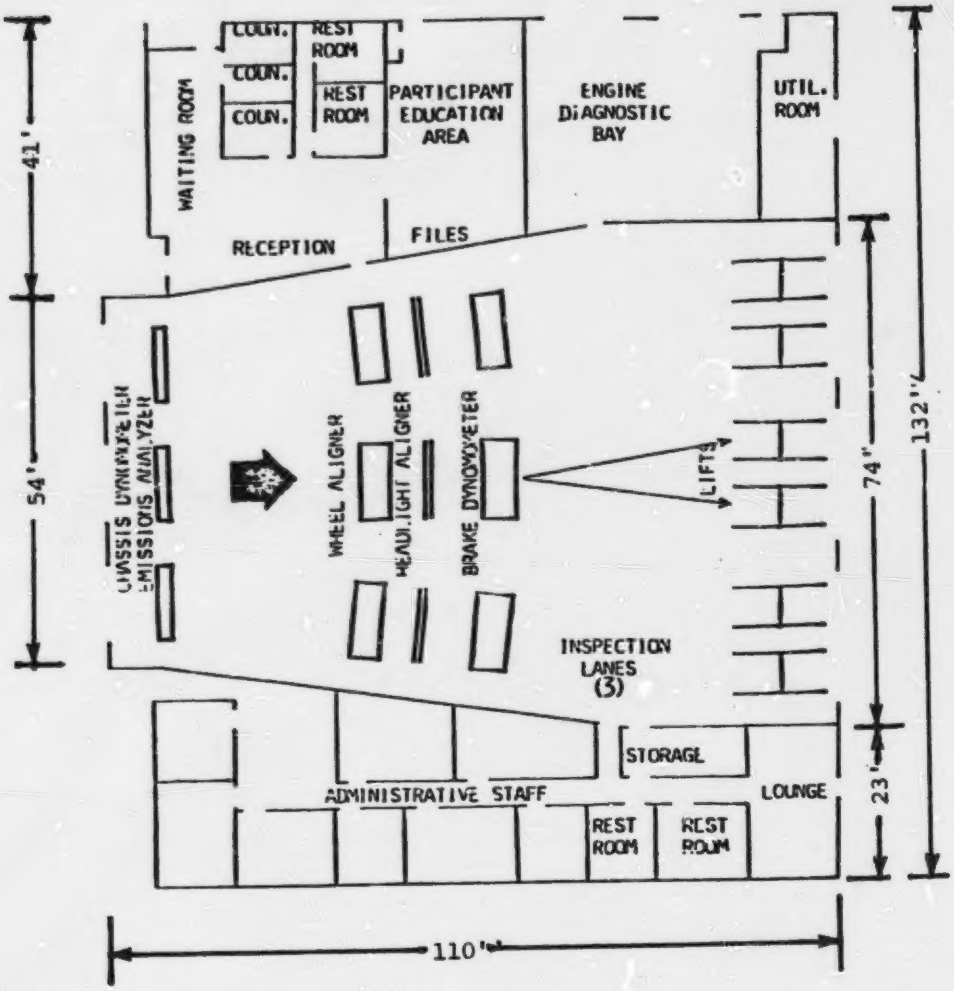
COUN.
REST ROOM
COUN.
REST ROOM
COUN.
WAITING ROOM
PARTICIPANT EDUCATION AREA
ENGINE DIAGNOSTIC BAY
UTIL. ROOM
RECEPTION
FILES
41'
54'
CHASSIS DYNAMOMETER
EMISSIONS ANALYZER
WHEEL ALIGNER
HEADLIGHT ALIGNER
BRAKE DYNAMOMETER
LIFTS
74'
132'
INSPECTION LANES (3)
STORAGE
ADMINISTRATIVE STAFF
LOUNGE
REST ROOM
REST ROOM
23'
110'

FIGURE 1. LAYOUT OF HUNTSVILLE, ALABAMA DIAGNOSTIC DEMONSTRATION PROJECT

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- Station 1 - underhood and emissions test
- Station 2 - wheel alignment
- Station 3 - headlight alignment
- Station 4 - braking balance between wheels; illumination and signal light
- Station 5 - wheel pull for brake inspection; fuel system, exhaust system, steering linkage; suspension system visual check
- Bay (only if a treatment group vehicle failed the emissions test) - engine ignition system analysis.

3. Data Handling:

   - Motorist provided repair bill and vehicle operational data (if maintained)
   - Inspector manually noted inspection pass/fail data (Figure 2).

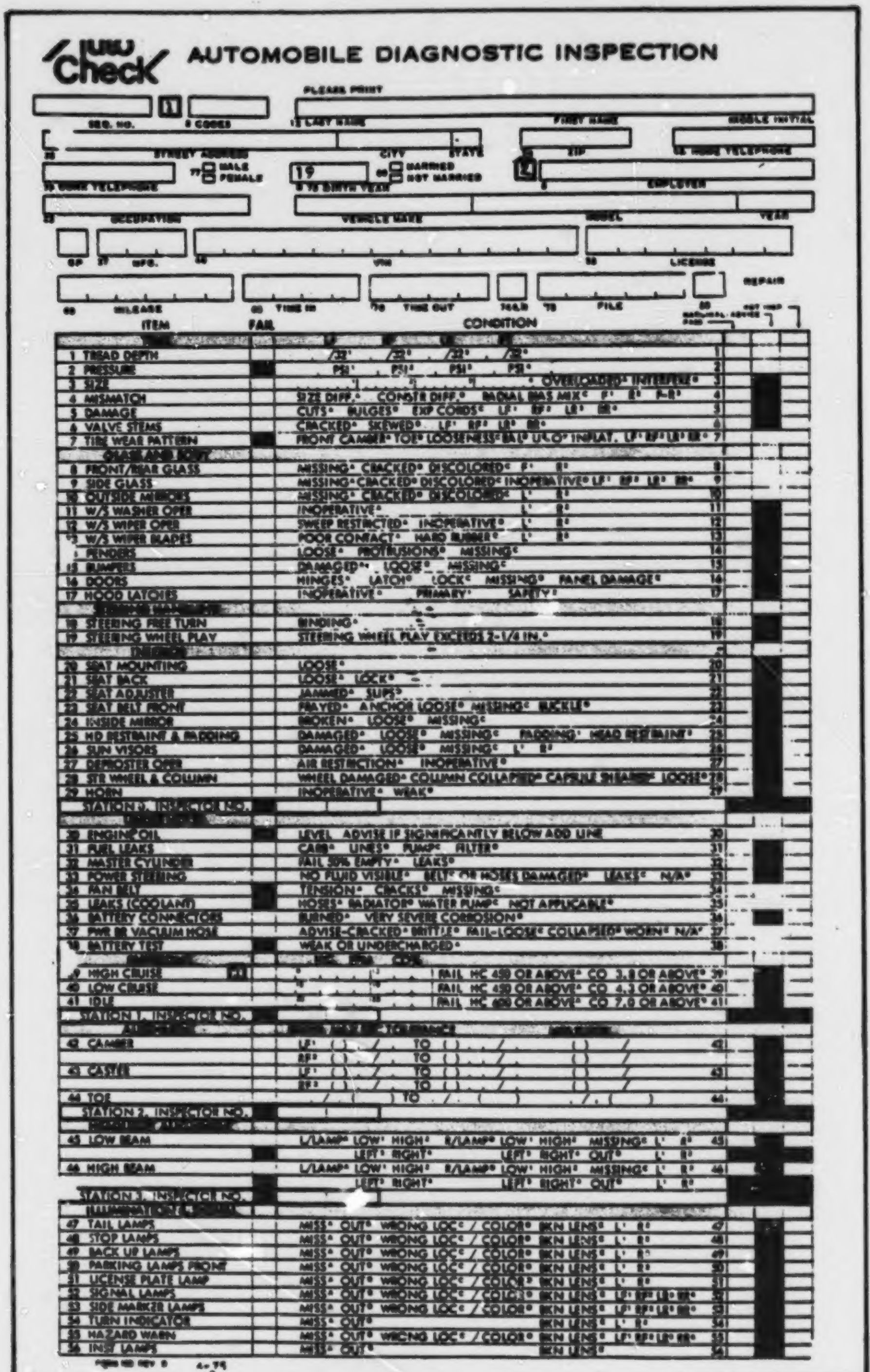
4. Check Out:

   - Inspection results and need for repairs and reinspection were explained in a counseling session which lasted 5 to 15 minutes.
   - An inspection form was provided to the participant for his use in understanding the status of his vehicle and the needed repairs. Figure 3 illustrates the form given to the treatment group.

IV. FEES

1. Diagnostic Inspection: The diagnostic inspection was free to the participants in the program.

2. Other Services: If needed, tires were properly inflated. If easily corrected, the headlights were properly aimed. Both services were provided free of charge.



AUTO CHECK AUTOMOBILE DIAGNOSTIC INSPECTION

PLEASE PRINT
SEQ. NO. 1 | 9 CODES | 13 LAST NAME | FIRST NAME | MIDDLE INITIAL
STREET ADDRESS | CITY | STATE | ZIP | HOME TELEPHONE
WORK TELEPHONE | 77 ☐ MALE ☐ FEMALE | 19 BIRTH YEAR | ☐ MARRIED ☐ NOT MARRIED | 2 | EMPLOYER
OCCUPATION | VEHICLE MAKE | MODEL | YEAR
GP | 37 MFG. | VIN | LICENSE
MILEAGE | TIME IN | TIME OUT | [illegible] | FILE | REPAIR

ITEM	FAIL	CONDITION	
[illegible]			
1 TREAD DEPTH		/32 /32 /32 /32	1
2 PRESSURE		PSI PSI PSI PSI	2
3 SIZE		OVERLOADED INTERFERE	3
4 MISMATCH		SIZE DIFF. CONSTR DIFF. RADIAL BIAS MIX F R F-R	4
5 DAMAGE		CUTS BULGES EXP CORDS LF RF LR RR	5
6 VALVE STEMS		CRACKED SKEWED LF RF LR RR	6
7 TIRE WEAR PATTERN		FRONT CAMBER TOE LOOSENESS BAL U/O INFLAT. LF RF LR RR	7
GLASS AND BODY			
8 FRONT/REAR GLASS		MISSING CRACKED DISCOLORED F R	8
9 SIDE GLASS		MISSING CRACKED DISCOLORED INOPERATIVE LF RF LR RR	9
10 OUTSIDE MIRRORS		MISSING CRACKED DISCOLORED L R	10
11 W/S WASHER OPER		INOPERATIVE L R	11
12 W/S WIPER OPER		SWEEP RESTRICTED INOPERATIVE L R	12
13 W/S WIPER BLADES		POOR CONTACT HARD RUBBER L R	13
14 FENDERS		LOOSE PROTRUSIONS MISSING	14
15 BUMPERS		DAMAGED LOOSE MISSING	15
16 DOORS		HINGES LATCH LOCK MISSING PANEL DAMAGE	16
17 HOOD LATCHES		INOPERATIVE PRIMARY SAFETY	17
[illegible]			
18 STEERING FREE TURN		BINDING	18
19 STEERING WHEEL PLAY		STEERING WHEEL PLAY EXCEEDS 2-1/4 IN.	19
INTERIOR			
20 SEAT MOUNTING		LOOSE	20
21 SEAT BACK		LOOSE LOCK	21
22 SEAT ADJUSTER		JAMMED SLIPS	22
23 SEAT BELT FRONT		FRAYED ANCHOR LOOSE MISSING BUCKLE	23
24 INSIDE MIRROR		BROKEN LOOSE MISSING	24
25 HD RESTRAINT & PADDING		DAMAGED LOOSE MISSING PADDING HEAD RESTRAINT	25
26 SUN VISORS		DAMAGED LOOSE MISSING L R	26
27 DEFROSTER OPER		AIR RESTRICTION INOPERATIVE	27
28 STR WHEEL & COLUMN		WHEEL DAMAGED COLUMN COLLAPSED CAPSULE SHEARED LOOSE	28
29 HORN		INOPERATIVE WEAK	29
STATION 3, INSPECTOR NO.			
[illegible]			
30 ENGINE OIL		LEVEL ADVISE IF SIGNIFICANTLY BELOW ADD LINE	30
31 FUEL LEAKS		CARB LINES PUMP FILTER	31
32 MASTER CYLINDER		FAIL 50% EMPTY LEAKS	32
33 POWER STEERING		NO FLUID VISIBLE BELT OR HOSES DAMAGED LEAKS N/A	33
34 FAN BELT		TENSION CRACKS MISSING	34
35 LEAKS (COOLANT)		HOSES RADIATOR WATER PUMP NOT APPLICABLE	35
36 BATTERY CONNECTORS		BURNED VERY SEVERE CORROSION	36
37 PWR BR VACUUM HOSE		ADVISE-CRACKED BRITTLE FAIL-LOOSE COLLAPSED WORN N/A	37
38 BATTERY TEST		WEAK OR UNDERCHARGED	38
[illegible]		[illegible] RPM CO	
39 HIGH CRUISE		FAIL HC 450 OR ABOVE CO 3.8 OR ABOVE	39
40 LOW CRUISE		FAIL HC 450 OR ABOVE CO 4.3 OR ABOVE	40
41 IDLE		FAIL HC 600 OR ABOVE CO 7.0 OR ABOVE	41
STATION 1, INSPECTOR NO.			
[illegible]		[illegible] TOLERANCE [illegible]	
42 CAMBER		LF ( ) . / . TO ( ) . . / . ( ) /	42
		RF ( ) . / . TO ( ) . . / . ( ) /	
43 CASTER		LF ( ) . / . TO ( ) . . / . ( ) /	43
		RF ( ) . / . TO ( ) . . / . ( ) /	
44 TOE		. / . ( ) TO . / . ( ) . / . ( )	44
STATION 2, INSPECTOR NO.			
[illegible]			
45 LOW BEAM		L/LAMP LOW HIGH R/LAMP LOW HIGH MISSING L R	45
		LEFT RIGHT LEFT RIGHT OUT L R	
46 HIGH BEAM		L/LAMP LOW HIGH R/LAMP LOW HIGH MISSING L R	46
		LEFT RIGHT LEFT RIGHT OUT L R	
STATION 3, INSPECTOR NO.			
ILLUMINATION [illegible]			
47 TAIL LAMPS		MISS OUT WRONG LOC / COLOR BKN LENS L R	47
48 STOP LAMPS		MISS OUT WRONG LOC / COLOR BKN LENS L R	48
49 BACK UP LAMPS		MISS OUT WRONG LOC / COLOR BKN LENS L R	49
50 PARKING LAMPS FRONT		MISS OUT WRONG LOC / COLOR BKN LENS L R	50
51 LICENSE PLATE LAMP		MISS OUT WRONG LOC / COLOR BKN LENS L R	51
52 SIGNAL LAMPS		MISS OUT WRONG LOC / COLOR BKN LENS LF RF LR RR	52
53 SIDE MARKER LAMPS		MISS OUT WRONG LOC / COLOR BKN LENS LF RF LR RR	53
54 TURN INDICATOR		MISS OUT BKN LENS L R	54
55 HAZARD WARN		MISS OUT WRONG LOC / COLOR BKN LENS LF RF LR RR	55
56 INST LAMPS		MISS OUT BKN LENS	56

[illegible] 4-75

FIGURE 2. AUTO CHECK DIAGNOSTIC INSPECTION FORM

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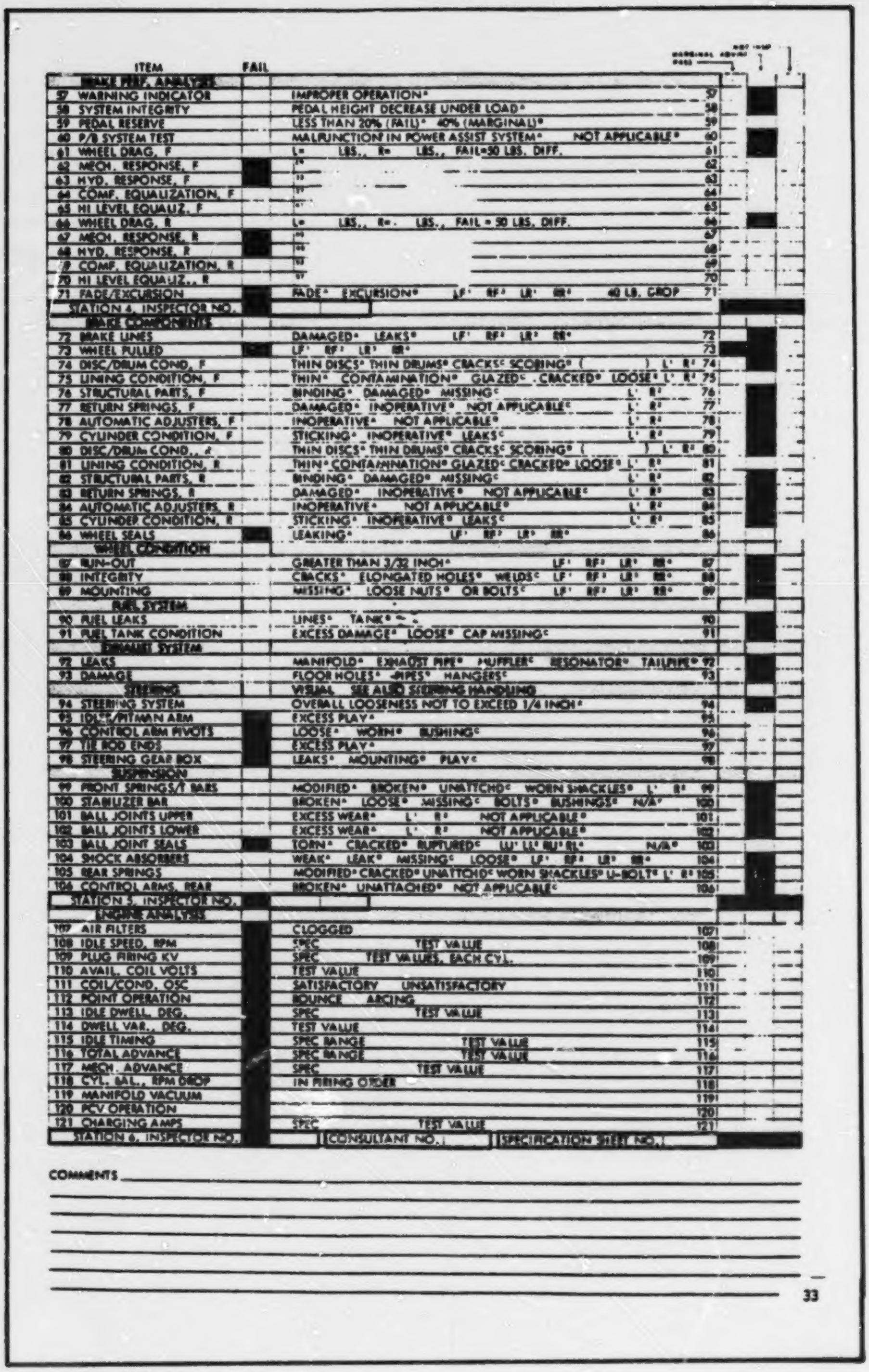

ITEM	FAIL			PASS	MARGINAL	ADVISE	NOT INSP
BRAKE PERF. ANALYSIS							
57 WARNING INDICATOR		IMPROPER OPERATION^{A}	57				
58 SYSTEM INTEGRITY		PEDAL HEIGHT DECREASE UNDER LOAD^{A}	58				
59 PEDAL RESERVE		LESS THAN 20% (FAIL)^{A} 40% (MARGINAL)^{B}	59				
60 P/B SYSTEM TEST		MALFUNCTION IN POWER ASSIST SYSTEM^{A} NOT APPLICABLE^{B}	60				
61 WHEEL DRAG, F		L= LBS., R= LBS., FAIL=50 LBS. DIFF.	61				
62 MECH. RESPONSE, F			62				
63 HYD. RESPONSE, F			63				
64 COMP. EQUALIZATION, F			64				
65 HI LEVEL EQUALIZ., F			65				
66 WHEEL DRAG, R		L= LBS., R= LBS., FAIL = 50 LBS. DIFF.	66				
67 MECH. RESPONSE, R			67				
68 HYD. RESPONSE, R			68				
69 COMP. EQUALIZATION, R			69				
70 HI LEVEL EQUALIZ., R			70				
71 FADE/EXCURSION		FADE^{A} EXCURSION^{B} LF^{1} RF^{2} LR^{3} RR^{4} 40 LB. DROP	71				
STATION 4, INSPECTOR NO.							
BRAKE COMPONENTS							
72 BRAKE LINES		DAMAGED^{A} LEAKS^{B} LF^{1} RF^{2} LR^{3} RR^{4}	72				
73 WHEEL PULLED		LF^{1} RF^{2} LR^{3} RR^{4}	73				
74 DISC/DRUM COND., F		THIN DISCS^{A} THIN DRUMS^{B} CRACKS^{C} SCORING^{D} ( ) L^{1} R^{2}	74				
75 LINING CONDITION, F		THIN^{A} CONTAMINATION^{B} GLAZED^{C} CRACKED^{D} LOOSE^{E} L^{1} R^{2}	75				
76 STRUCTURAL PARTS, F		BINDING^{A} DAMAGED^{B} MISSING^{C} L^{1} R^{2}	76				
77 RETURN SPRINGS, F		DAMAGED^{A} INOPERATIVE^{B} NOT APPLICABLE^{C} L^{1} R^{2}	77				
78 AUTOMATIC ADJUSTERS, F		INOPERATIVE^{A} NOT APPLICABLE^{B} L^{1} R^{2}	78				
79 CYLINDER CONDITION, F		STICKING^{A} INOPERATIVE^{B} LEAKS^{C} L^{1} R^{2}	79				
80 DISC/DRUM COND., R		THIN DISCS^{A} THIN DRUMS^{B} CRACKS^{C} SCORING^{D} ( ) L^{1} R^{2}	80				
81 LINING CONDITION, R		THIN^{A} CONTAMINATION^{B} GLAZED^{C} CRACKED^{D} LOOSE^{E} L^{1} R^{2}	81				
82 STRUCTURAL PARTS, R		BINDING^{A} DAMAGED^{B} MISSING^{C} L^{1} R^{2}	82				
83 RETURN SPRINGS, R		DAMAGED^{A} INOPERATIVE^{B} NOT APPLICABLE^{C} L^{1} R^{2}	83				
84 AUTOMATIC ADJUSTERS, R		INOPERATIVE^{A} NOT APPLICABLE^{B} L^{1} R^{2}	84				
85 CYLINDER CONDITION, R		STICKING^{A} INOPERATIVE^{B} LEAKS^{C} L^{1} R^{2}	85				
86 WHEEL SEALS		LEAKING^{A} LF^{1} RF^{2} LR^{3} RR^{4}	86				
WHEEL CONDITION							
87 RUN-OUT		GREATER THAN 3/32 INCH^{A} LF^{1} RF^{2} LR^{3} RR^{4}	87				
88 INTEGRITY		CRACKS^{A} ELONGATED HOLES^{B} WELDS^{C} LF^{1} RF^{2} LR^{3} RR^{4}	88				
89 MOUNTING		MISSING^{A} LOOSE NUTS^{B} OR BOLTS^{C} LF^{1} RF^{2} LR^{3} RR^{4}	89				
FUEL SYSTEM							
90 FUEL LEAKS		LINES^{A} TANK^{B}	90				
91 FUEL TANK CONDITION		EXCESS DAMAGE^{A} LOOSE^{B} CAP MISSING^{C}	91				
EXHAUST SYSTEM							
92 LEAKS		MANIFOLD^{A} EXHAUST PIPE^{B} MUFFLER^{C} RESONATOR^{D} TAILPIPE^{E}	92				
93 DAMAGE		FLOOR HOLES^{A} PIPES^{B} HANGERS^{C}	93				
STEERING		VISUAL SEE ALSO STEERING HANDLING					
94 STEERING SYSTEM		OVERALL LOOSENESS NOT TO EXCEED 1/4 INCH^{A}	94				
95 IDLER/PITMAN ARM		EXCESS PLAY^{A}	95				
96 CONTROL ARM PIVOTS		LOOSE^{A} WORN^{B} BUSHING^{C}	96				
97 TIE ROD ENDS		EXCESS PLAY^{A}	97				
98 STEERING GEAR BOX		LEAKS^{A} MOUNTING^{B} PLAY^{C}	98				
SUSPENSION							
99 FRONT SPRINGS/T BARS		MODIFIED^{A} BROKEN^{B} UNATTCHD^{C} WORN SHACKLES^{D} L^{1} R^{2}	99				
100 STABILIZER BAR		BROKEN^{A} LOOSE^{B} MISSING^{C} BOLTS^{D} BUSHINGS^{E} N/A^{F}	100				
101 BALL JOINTS UPPER		EXCESS WEAR^{A} L^{1} R^{2} NOT APPLICABLE^{B}	101				
102 BALL JOINTS LOWER		EXCESS WEAR^{A} L^{1} R^{2} NOT APPLICABLE^{B}	102				
103 BALL JOINT SEALS		TORN^{A} CRACKED^{B} RUPTURED^{C} LU^{1} LL^{2} RU^{3} RL^{4} N/A^{D}	103				
104 SHOCK ABSORBERS		WEAK^{A} LEAK^{B} MISSING^{C} LOOSE^{D} LF^{1} RF^{2} LR^{3} RR^{4}	104				
105 REAR SPRINGS		MODIFIED^{A} CRACKED^{B} UNATTCHD^{C} WORN SHACKLES^{D} U-BOLT^{E} L^{1} R^{2}	105				
106 CONTROL ARMS, REAR		BROKEN^{A} UNATTACHED^{B} NOT APPLICABLE^{C}	106				
STATION 5, INSPECTOR NO.							
ENGINE ANALYSIS							
107 AIR FILTERS		CLOGGED	107				
108 IDLE SPEED, RPM		SPEC TEST VALUE	108				
109 PLUG FIRING KV		SPEC TEST VALUES, EACH CYL.	109				
110 AVAIL. COIL VOLTS		TEST VALUE	110				
111 COIL/COND. OSC		SATISFACTORY UNSATISFACTORY	111				
112 POINT OPERATION		BOUNCE ARCING	112				
113 IDLE DWELL, DEG.		SPEC TEST VALUE	113				
114 DWELL VAR., DEG.		TEST VALUE	114				
115 IDLE TIMING		SPEC RANGE TEST VALUE	115				
116 TOTAL ADVANCE		SPEC RANGE TEST VALUE	116				
117 MECH. ADVANCE		SPEC TEST VALUE	117				
118 CYL. BAL., RPM DROP		IN FIRING ORDER	118				
119 MANIFOLD VACUUM			119				
120 PCV OPERATION			120				
121 CHARGING AMPS		SPEC TEST VALUE	121				
STATION 6, INSPECTOR NO.		CONSULTANT NO. SPECIFICATION SHEET NO.					

COMMENTS ______

33

FIGURE 2. (Continued)

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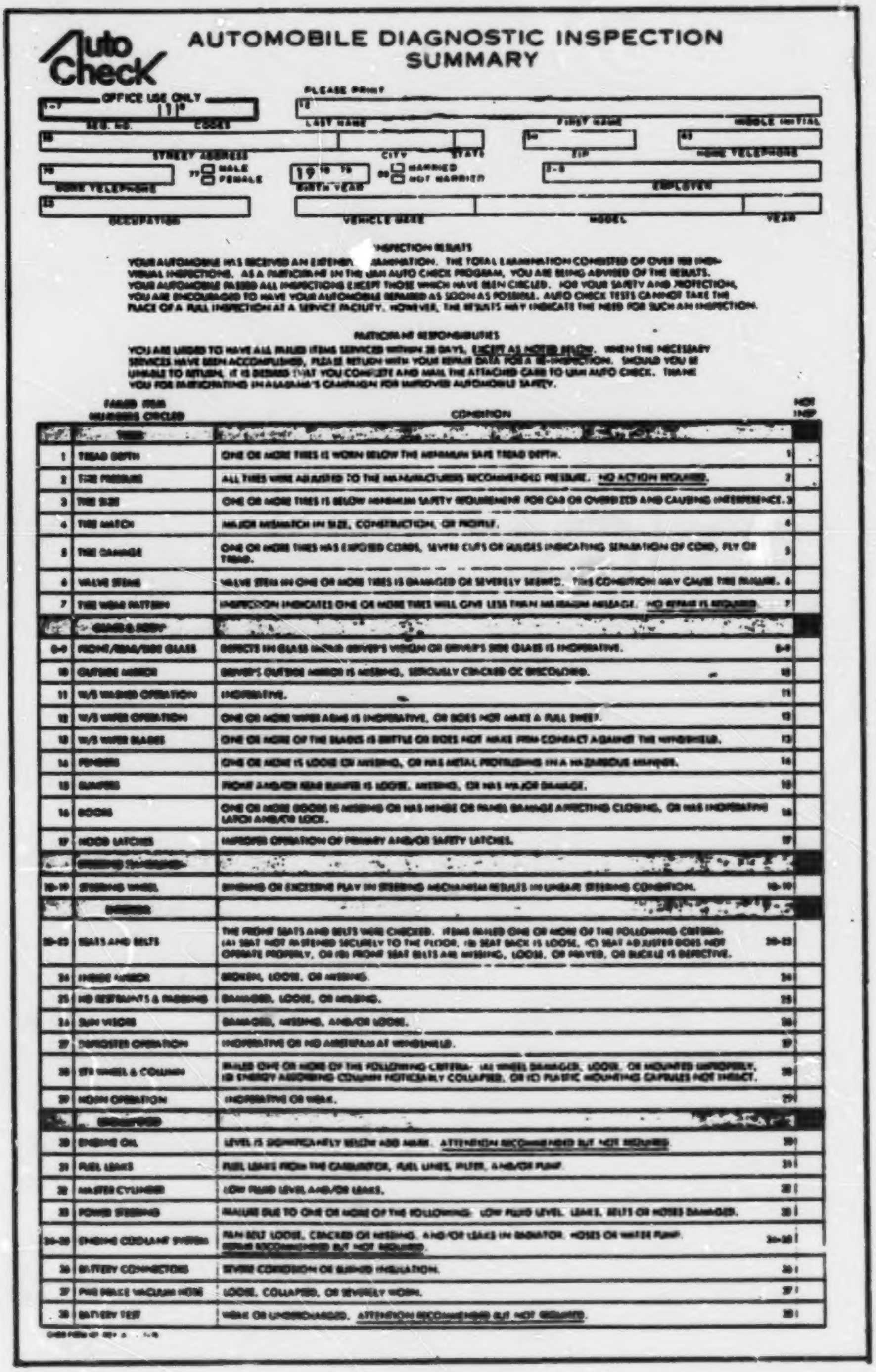

Auto Check

AUTOMOBILE DIAGNOSTIC INSPECTION SUMMARY

OFFICE USE ONLY
1-7 11 8
SEQ. NO. CODES

PLEASE PRINT
12
LAST NAME FIRST NAME MIDDLE INITIAL

STREET ADDRESS CITY STATE ZIP HOME TELEPHONE

WORK TELEPHONE ☐ MALE ☐ FEMALE 19 BIRTH YEAR ☐ MARRIED ☐ NOT MARRIED EMPLOYER

OCCUPATION VEHICLE MAKE MODEL YEAR

INSPECTION RESULTS

YOUR AUTOMOBILE HAS RECEIVED AN EXTENSIVE EXAMINATION. THE TOTAL EXAMINATION CONSISTED OF OVER 100 INDIVIDUAL INSPECTIONS. AS A PARTICIPANT IN THE UAH AUTO CHECK PROGRAM, YOU ARE BEING ADVISED OF THE RESULTS. YOUR AUTOMOBILE PASSED ALL INSPECTIONS EXCEPT THOSE WHICH HAVE BEEN CIRCLED. FOR YOUR SAFETY AND PROTECTION, YOU ARE ENCOURAGED TO HAVE YOUR AUTOMOBILE REPAIRED AS SOON AS POSSIBLE. AUTO CHECK TESTS CANNOT TAKE THE PLACE OF A FULL INSPECTION AT A SERVICE FACILITY. HOWEVER, THE RESULTS MAY INDICATE THE NEED FOR SUCH AN INSPECTION.

PARTICIPANT RESPONSIBILITIES

YOU ARE URGED TO HAVE ALL FAILED ITEMS SERVICED WITHIN 30 DAYS, EXCEPT AS NOTED BELOW. WHEN THE NECESSARY SERVICES HAVE BEEN ACCOMPLISHED, PLEASE RETURN WITH YOUR REPAIR DATA FOR A RE-INSPECTION. SHOULD YOU BE UNABLE TO RETURN, IT IS DESIRED THAT YOU COMPLETE AND MAIL THE ATTACHED CARD TO UAH AUTO CHECK. THANK YOU FOR PARTICIPATING IN ALABAMA'S CAMPAIGN FOR IMPROVED AUTOMOBILE SAFETY.

FAILED ITEM NUMBERS CIRCLED		CONDITION		NOT INSP
	TIRES			
1	TREAD DEPTH	ONE OR MORE TIRES IS WORN BELOW THE MINIMUM SAFE TREAD DEPTH.	1	
2	TIRE PRESSURE	ALL TIRES WERE ADJUSTED TO THE MANUFACTURERS RECOMMENDED PRESSURE. NO ACTION REQUIRED.	2	
3	TIRE SIZE	ONE OR MORE TIRES IS BELOW MINIMUM SAFETY REQUIREMENT FOR CAR OR OVERSIZED AND CAUSING INTERFERENCE.	3	
4	TIRE MATCH	MAJOR MISMATCH IN SIZE, CONSTRUCTION, OR PROFILE.	4	
5	TIRE DAMAGE	ONE OR MORE TIRES HAS EXPOSED CORDS, SEVERE CUTS OR BULGES INDICATING SEPARATION OF CORD, PLY OR TREAD.	5	
6	VALVE STEMS	VALVE STEM IN ONE OR MORE TIRES IS DAMAGED OR SEVERELY SKEWED. THIS CONDITION MAY CAUSE TIRE FAILURE.	6	
7	TIRE WEAR PATTERN	INSPECTION INDICATES ONE OR MORE TIRES WILL GIVE LESS THAN MAXIMUM MILEAGE. NO REPAIR IS REQUIRED.	7	
	GLASS & BODY			
8-9	FRONT/REAR/SIDE GLASS	DEFECTS IN GLASS IMPAIR DRIVER'S VISION OR DRIVER'S SIDE GLASS IS INOPERATIVE.	8-9	
10	OUTSIDE MIRROR	DRIVER'S OUTSIDE MIRROR IS MISSING, SERIOUSLY CRACKED OR DISCOLORED.	10	
11	W/S WASHER OPERATION	INOPERATIVE.	11	
12	W/S WIPER OPERATION	ONE OR MORE WIPER ARMS IS INOPERATIVE, OR DOES NOT MAKE A FULL SWEEP.	12	
13	W/S WIPER BLADES	ONE OR MORE OF THE BLADES IS BRITTLE OR DOES NOT MAKE FIRM CONTACT AGAINST THE WINDSHIELD.	13	
14	FENDERS	ONE OR MORE IS LOOSE OR MISSING, OR HAS METAL PROTRUDING IN A HAZARDOUS MANNER.	14	
15	BUMPERS	FRONT AND/OR REAR BUMPER IS LOOSE, MISSING, OR HAS MAJOR DAMAGE.	15	
16	DOORS	ONE OR MORE DOORS IS MISSING OR HAS HINGE OR PANEL DAMAGE AFFECTING CLOSING, OR HAS INOPERATIVE LATCH AND/OR LOCK.	16	
17	HOOD LATCHES	IMPROPER OPERATION OF PRIMARY AND/OR SAFETY LATCHES.	17	
	STEERING [illegible]			
18-19	STEERING WHEEL	BINDING OR EXCESSIVE PLAY IN STEERING MECHANISM RESULTS IN UNSAFE STEERING CONDITION.	18-19	
	INTERIOR			
20-23	SEATS AND BELTS	THE FRONT SEATS AND BELTS WERE CHECKED. ITEMS FAILED ONE OR MORE OF THE FOLLOWING CRITERIA: (A) SEAT NOT FASTENED SECURELY TO THE FLOOR, (B) SEAT BACK IS LOOSE, (C) SEAT ADJUSTER DOES NOT OPERATE PROPERLY, OR (D) FRONT SEAT BELTS ARE MISSING, LOOSE, OR FRAYED, OR BUCKLE IS DEFECTIVE.	20-23	
24	INSIDE MIRROR	BROKEN, LOOSE, OR MISSING.	24	
25	HD RESTRAINTS & PADDING	DAMAGED, LOOSE, OR MISSING.	25	
26	SUN VISORS	DAMAGED, MISSING, AND/OR LOOSE.	26	
27	DEFROSTER OPERATION	INOPERATIVE OR NO AIRSTREAM AT WINDSHIELD.	27	
28	STR WHEEL & COLUMN	FAILED ONE OR MORE OF THE FOLLOWING CRITERIA: (A) WHEEL DAMAGED, LOOSE, OR MOUNTED IMPROPERLY, (B) ENERGY ABSORBING COLUMN NOTICEABLY COLLAPSED, OR (C) PLASTIC MOUNTING CAPSULES NOT INTACT.	28	
29	HORN OPERATION	INOPERATIVE OR WEAK.	29	
	UNDERHOOD			
30	ENGINE OIL	LEVEL IS SIGNIFICANTLY BELOW ADD MARK. ATTENTION RECOMMENDED BUT NOT REQUIRED.	30	
31	FUEL LEAKS	FUEL LEAKS FROM THE CARBURETOR, FUEL LINES, FILTER, AND/OR PUMP.	31	
32	MASTER CYLINDER	LOW FLUID LEVEL AND/OR LEAKS.	32	
33	POWER STEERING	FAILURE DUE TO ONE OR MORE OF THE FOLLOWING: LOW FLUID LEVEL, LEAKS, BELTS OR HOSES DAMAGED.	33	
34-35	ENGINE COOLANT SYSTEM	FAN BELT LOOSE, CRACKED OR MISSING, AND/OR LEAKS IN RADIATOR, HOSES OR WATER PUMP. REPAIR RECOMMENDED BUT NOT REQUIRED.	34-35	
36	BATTERY CONNECTORS	SEVERE CORROSION OR BURNED INSULATION.	36	
37	PWR BRAKE VACUUM HOSE	LOOSE, COLLAPSED, OR SEVERELY WORN.	37	
38	BATTERY TEST	WEAK OR UNDERCHARGED. ATTENTION RECOMMENDED BUT NOT REQUIRED.	38	

FIGURE 3. AUTOMOBILE DIAGNOSTIC INSPECTION FORM

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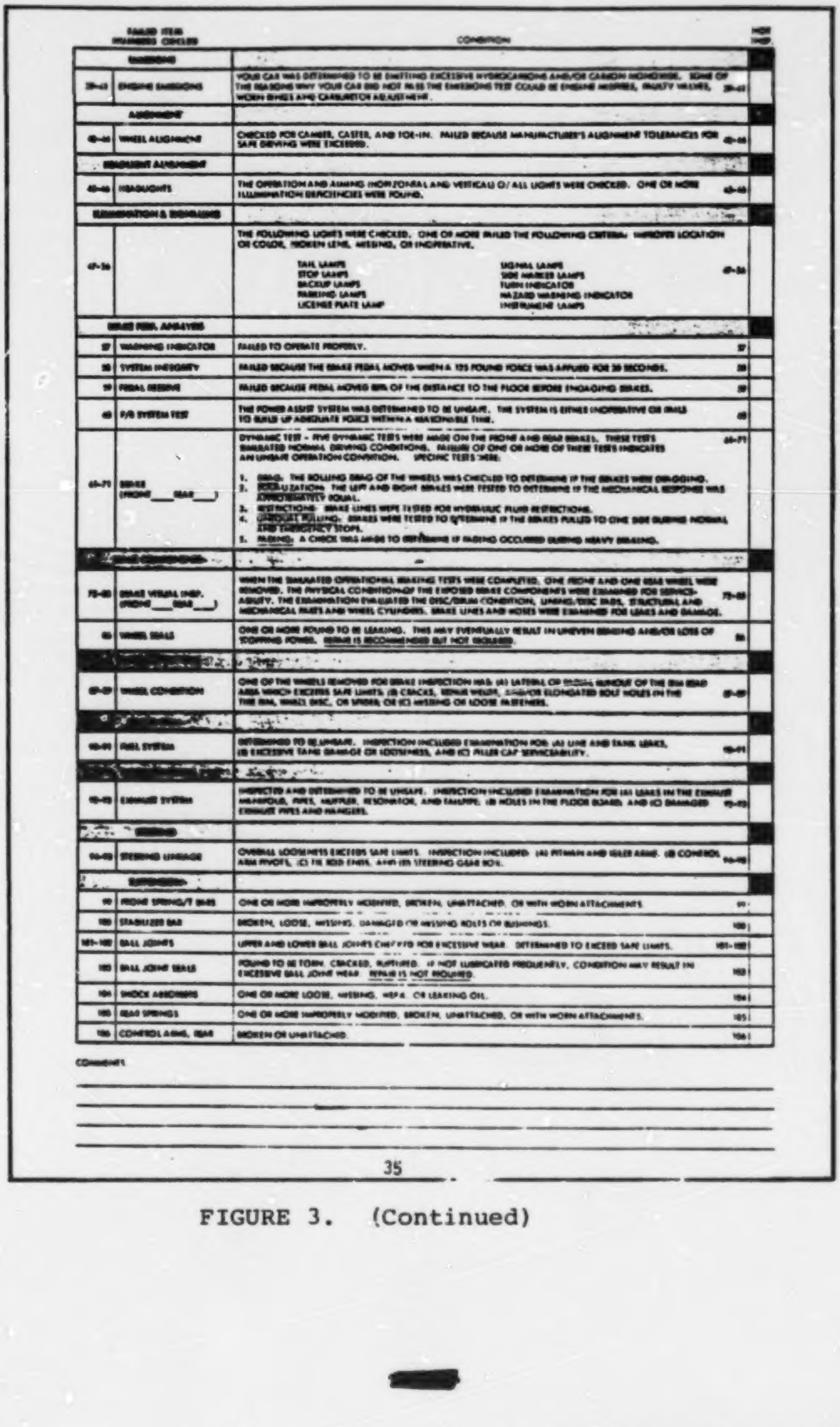

FAILED ITEM NUMBERS CIRCLED		CONDITION		NOT INSP.
EMISSIONS				
39-41	ENGINE EMISSIONS	YOUR CAR WAS DETERMINED TO BE EMITTING EXCESSIVE HYDROCARBONS AND/OR CARBON MONOXIDE. SOME OF THE REASONS WHY YOUR CAR DID NOT PASS THE EMISSIONS TEST COULD BE ENGINE MISFIRES, FAULTY VALVES, WORN RINGS AND CARBURETOR ADJUSTMENT.	39-41	
ALIGNMENT				
42-44	WHEEL ALIGNMENT	CHECKED FOR CAMBER, CASTER, AND TOE-IN. FAILED BECAUSE MANUFACTURER'S ALIGNMENT TOLERANCES FOR SAFE DRIVING WERE EXCEEDED.	42-44	
HEADLIGHT ALIGNMENT				
45-46	HEADLIGHTS	THE OPERATION AND AIMING (HORIZONTAL AND VERTICAL) OF ALL LIGHTS WERE CHECKED. ONE OR MORE ILLUMINATION DEFICIENCIES WERE FOUND.	45-46	
ILLUMINATION & SIGNALING				
47-56		THE FOLLOWING LIGHTS WERE CHECKED. ONE OR MORE FAILED THE FOLLOWING CRITERIA: IMPROPER LOCATION OR COLOR, BROKEN LENS, MISSING, OR INOPERATIVE. TAIL LAMPS STOP LAMPS BACKUP LAMPS PARKING LAMPS LICENSE PLATE LAMP SIGNAL LAMPS SIDE MARKER LAMPS TURN INDICATOR HAZARD WARNING INDICATOR INSTRUMENT LAMPS	47-56	
BRAKE PERF. ANALYSIS				
57	WARNING INDICATOR	FAILED TO OPERATE PROPERLY.	57	
58	SYSTEM INTEGRITY	FAILED BECAUSE THE BRAKE PEDAL MOVED WHEN A 125 POUND FORCE WAS APPLIED FOR 30 SECONDS.	58	
59	PEDAL RESERVE	FAILED BECAUSE PEDAL MOVED 80% OF THE DISTANCE TO THE FLOOR BEFORE ENGAGING BRAKES.	59	
60	P/B SYSTEM TEST	THE POWER ASSIST SYSTEM WAS DETERMINED TO BE UNSAFE. THE SYSTEM IS EITHER INOPERATIVE OR FAILS TO BUILD UP ADEQUATE FORCE WITHIN A REASONABLE TIME.	60	
61-71	BRAKE (FRONT____ REAR____)	DYNAMIC TEST – FIVE DYNAMIC TESTS WERE MADE ON THE FRONT AND REAR BRAKES. THESE TESTS SIMULATED NORMAL DRIVING CONDITIONS. FAILURE OF ONE OR MORE OF THESE TESTS INDICATES AN UNSAFE OPERATION CONDITION. SPECIFIC TESTS WERE: 1. DRAG: THE ROLLING DRAG OF THE WHEELS WAS CHECKED TO DETERMINE IF THE BRAKES WERE DRAGGING. 2. EQUALIZATION: THE LEFT AND RIGHT BRAKES WERE TESTED TO DETERMINE IF THE MECHANICAL RESPONSE WAS APPROXIMATELY EQUAL. 3. RESTRICTIONS: BRAKE LINES WERE TESTED FOR HYDRAULIC FLUID RESTRICTIONS. 4. UNEQUAL PULLING: BRAKES WERE TESTED TO DETERMINE IF THE BRAKES PULLED TO ONE SIDE DURING NORMAL AND EMERGENCY STOPS. 5. FADING: A CHECK WAS MADE TO DETERMINE IF FADING OCCURRED DURING HEAVY BRAKING.	61-71	
BRAKE COMPONENTS				
72-85	BRAKE VISUAL INSP. (FRONT____ REAR____)	WHEN THE SIMULATED OPERATIONAL BRAKING TESTS WERE COMPLETED, ONE FRONT AND ONE REAR WHEEL WERE REMOVED. THE PHYSICAL CONDITION OF THE EXPOSED BRAKE COMPONENTS WERE EXAMINED FOR SERVICEABILITY. THE EXAMINATION EVALUATED THE DISC/DRUM CONDITION, LINING/DISC PADS, STRUCTURAL AND MECHANICAL PARTS AND WHEEL CYLINDERS. BRAKE LINES AND HOSES WERE EXAMINED FOR LEAKS AND DAMAGE.	72-85	
86	WHEEL SEALS	ONE OR MORE FOUND TO BE LEAKING. THIS MAY EVENTUALLY RESULT IN UNEVEN BRAKING AND/OR LOSS OF STOPPING POWER. REPAIR IS RECOMMENDED BUT NOT REQUIRED.	86	
[illegible]				
87-89	WHEEL CONDITION	ONE OF THE WHEELS REMOVED FOR BRAKE INSPECTION HAS: (A) LATERAL OR RADIAL RUNOUT OF THE RIM READ AREA WHICH EXCEEDS SAFE LIMITS; (B) CRACKS, REPAIR WELDS, AND/OR ELONGATED BOLT HOLES IN THE TIRE RIM, WHEEL DISC, OR SPIDER; OR (C) MISSING OR LOOSE FASTENERS.	87-89	
[illegible]				
90-91	FUEL SYSTEM	DETERMINED TO BE UNSAFE. INSPECTION INCLUDED EXAMINATION FOR: (A) LINE AND TANK LEAKS, (B) EXCESSIVE TANK DAMAGE OR LOOSENESS, AND (C) FILLER CAP SERVICEABILITY.	90-91	
[illegible]				
92-93	EXHAUST SYSTEM	INSPECTED AND DETERMINED TO BE UNSAFE. INSPECTION INCLUDED EXAMINATION FOR (A) LEAKS IN THE EXHAUST MANIFOLD, PIPES, MUFFLER, RESONATOR, AND TAILPIPE; (B) HOLES IN THE FLOOR BOARD; AND (C) DAMAGED EXHAUST PIPES AND HANGERS.	92-93	
STEERING				
94-98	STEERING LINKAGE	OVERALL LOOSENESS EXCEEDS SAFE LIMITS. INSPECTION INCLUDED: (A) PITMAN AND IDLER ARMS, (B) CONTROL ARM PIVOTS, (C) TIE ROD ENDS, AND (D) STEERING GEAR BOX.	94-98	
SUSPENSION				
99	FRONT SPRING/T BARS	ONE OR MORE IMPROPERLY MODIFIED, BROKEN, UNATTACHED, OR WITH WORN ATTACHMENTS.	99	
100	STABILIZER BAR	BROKEN, LOOSE, MISSING, DAMAGED OR MISSING BOLTS OR BUSHINGS.	100	
101-102	BALL JOINTS	UPPER AND LOWER BALL JOINTS CHECKED FOR EXCESSIVE WEAR. DETERMINED TO EXCEED SAFE LIMITS.	101-102	
103	BALL JOINT SEALS	FOUND TO BE TORN, CRACKED, RUPTURED. IF NOT LUBRICATED FREQUENTLY, CONDITION MAY RESULT IN EXCESSIVE BALL JOINT WEAR. REPAIR IS NOT REQUIRED.	103	
104	SHOCK ABSORBERS	ONE OR MORE LOOSE, MISSING, WEAK, OR LEAKING OIL.	104	
105	REAR SPRINGS	ONE OR MORE IMPROPERLY MODIFIED, BROKEN, UNATTACHED, OR WITH WORN ATTACHMENTS.	105	
106	CONTROL ARMS, REAR	BROKEN OR UNATTACHED.	106	

COMMENTS

FIGURE 3. (Continued)

310 BEST DOCUMENT AVAILABLE

V. TEST EQUIPMENT

1. Brakes - each lane contained a Clayton DB-8-CP brake dynamometer.

2. Alignment - each lane contained a Hunter F-60 which gave a computed reading for caster, camber and toe.

3. Headlight Aim - each lane contained a Hunter HD Ray-O-Scope.

4. Lift - each lane branched into two lift stations. There were 6 Dover Corporation WABV-28-H Twin Post lifts with Hunter Engineering Company Model DA 30-inch Twin Post Rack.

5. Emission Analyzer - each lane contained an emissions analyzer. The models used were 2 Chrysler Exhaust Gas Analyzer Models I, one Model IV. A portable model (III-C) was available in the bay area.

6. Engine Analyzer - two Clayton CSS-7100 analyzers were located in the bay area.

7. Dynamometer - each lane contained a chassis dynamometer, Clayton C720/key Mode SCT, to permit loaded mode emissions testing, as well as the previously mentioned brake dynamometers.

8. Noise Testing - None.

9. Fuel Economy - None.

10. Backup: The redundancy of equipment permitted backup until the degraded equipment was corrected.

11. Technical Library: A library of service manuals on 1968-1973 vehicles (including all in the NHTSA sample group) and of training materials was accumulated. The training materials included slide/tape, 8mm movie films, and MOTech slide presentations on auto engine fundamentals, smog control and ventilation, carburetion theory, dynamometer set-up procedures, testing procedures for engine timing inspection, component (tires, wheels, disc and drum brakes, ball joints, under-chassis) maintenance and repair.

12. Mobile Equipment - None.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance:

Equipment	Maintenance Schedule
. Wheel Alignment Analyzer	a) clean-weekly b) lubricate-weekly
. Chassis Dynamometer	a) clean-daily b) adjust-monthly c) lubricate-semi-annually
. Brake Dynamometer	a) clean-daily b) lubricate-semi-annually
. Engine Analyzer	a) pickups-daily b) console-weekly
. Exhaust Emission Analyzer	a) function check-daily
. Headlight Aligner	a) visual check-monthly

2. Frequency of Equipment Calibration:

Equipment	Calibration Schedule
. Wheel Alignment Analyses Hunter F-60	a) quick check-weekly b) calibration monthly
. Chassis Dynamometer - Clayton C 720	quarterly
. Brake Dynamometer - Clayton DB-8-CP	quarterly
. Engine Analyzer - Clayton CSS/7100	weekly
. Exhaust Emission Analyzers Chrysler models	after repair
. Headlight Aligner - Hunter HD-Ray-O-Scope	a) floor cal.-daily b) side aim cal. after major repair

VII. FACILITY STAFFING

Not counting the program staff, who ensured contract liaison and analysis, the operating staff at the inspection facility included:

[redacted]

1. Site Supervisor: one - who supervised and directed the inspection activities.

2. Lane Supervisors: three - each directed an individual inspection lane.

3. Inspectors: fourteen - full-time inspectors performed the inspections and filled out forms.

4. Part-Time Inspectors: thirty-two - performed same functions as a full-time inspector.

5. Counselor: three - counseled participants on inspection results and how to maintain vehicle records.

6. Traffic Control: one - assigned lanes to arriving participants, maintained safe driving practices on the premises and maintained building security.

7. Receptionist: one - prepared inspection form and directed participant at intake.

8. Clerk-Typists: three - maintained record and appointment files.

VIII. TRAINING

1. Staff Experience:

   - Site supervisor - graduate of auto mechanics program with 5-10 years automobile repair experience

   - Lane supervisor - 3-5 years auto mechanic experience and experience with vehicle diagnostic equipment

   - Inspectors - University students, with mechanical aptitude but not trained in auto mechanics, who were given an intensive classroom and diagnostic equipment training at the onset of employment and continuous on-the-job training and supervision.

2. Employee Training:

   - 20 hours of classroom instruction and 20 hours of instruction directly on the diagnostic test equipment. Instruction was limited to four hours/day.

- On-the-job training at the individual inspection stations to permit flexibility in work assignments

- Random half-hour lessons to correct procedural problems.

IX. QUALITY CONTROL*

1. Supervision for Inspectors: The lane supervisor continuously monitored the activities of the inspectors, and also sampled inspection records for thoroughness and to spot trends.

2. Surveys of Customer Satisfaction:

   - Auto Check utilized a survey form which was given to each participant to complete voluntarily and anonymously before depositing it in a special box. This survey, which was started early in the program and continued till the end of the program, was continuously analyzed to improve service.

   - A mail survey was conducted of 2,000 Auto Check participants, including those who did not return after the first cycle of inspection. An analysis was made of the results to determine attitudinal reactions to the demonstration.

3. Criteria for Failure: Standard vehicle-in-use standards developed by ANSI and the Federal Government were used in conjunction with the manufacturers' specifications.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Reinspection following a failed inspection was made on an unscheduled basis within 30 days.

XI. CUSTOMER INTERFACE

1. Counseling: The participant was provided with a form listing the condition of subsystems and components of the vehicle (Figure 3). The counselor advised on potential remedies for repair. He did not provide proscriptive information, potential cost of repair, or make recommendations on utilization of specific repair facilities.

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* In addition to the measures cited in this section, all projects were monitored through on-site visits and reviews of procedures and documentation by a Technical Support contractor reporting to NHTSA. Visits were monthly until September 1975, then reduced to quarterly.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Total Process Time:

   - Including waits between stations - 42.5 minutes

   - Stations 0 through 5 - approximately 26 minutes

   - Diagnostic bay - approximately 10 minutes.

2. Time at Each Station:

   - Station 0 - approximately 5 minutes
   - Station 1 - approximately 4.4 minutes
   - Station 2 - approximately 3.0 minutes
   - Station 3 - approximately 2.0 minutes
   - Station 4 - approximately 3.3 minutes
   - Station 5 - approximately 8.2 minutes
   - Diagnostic Bay - approximately 10 minutes.

3. Theoretical Maximum Lane Throughput: 89 vehicles/lane/day.

4. Average Lane Throughput: 50 vehicles/lane/day.

5. Appointments Used:

   - Inspections - Yes

   - Reinspections - No.

XIII. CONSUMER AND COMMUNITY RELATIONS

The Auto Check developed understandings with the local repair facilities of its program to the point where a participant of the program was recognized by the Auto Check form. The repair was likely to be extremely thorough, since the repair facility realized that the vehicle would be reinspected by Auto Check.

The Auto Check program was also covered through media information releases so that the inspection program, and its objectives, were made known to the general public.

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* Some facilities offered Auto Check participants a 10% discount. They could do so because of the savings in diagnosis time and because the customers were "pre-sold," i.e., convinced the work needed to be done.

XIV. INVESTMENT AND OPERATING COSTS*

1. Facility:
   - Structure - $335,876
   - Land - $209,653 (including land acquisition, site prep, drive surface, etc.)
2. Equipment - $192,082.
3. Operational:
   - Inspectors - $4.64/hr.
   - Lane Supervisor - $5.73/hr.
   - Counselor - $ 4.64/hr.
   - Quality Control - $5.73/hr.
   - Site supervisor - $7.07/hr.

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* 1975-1976 Costs.

DIAGNOSTIC DEMONSTRATION PROJECT CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: VIP - Arizona Motor Vehicle
Diagnostic Inspection
Demonstration Project
4040 East 29 Street
Tucson, Arizona

2. Contact Name and Number: Mr. Vic Rothe
602-955-9670

3. General Description of Facility: A vehicle diagnostic inspection demonstration, sponsored by NHTSA,* was conducted by the State of Arizona in Phoenix and Tucson. The inspection process in both cities was contracted to Hamilton Test Systems. The demonstration project in Tucson started on April 28, 1975 and continued through June 30, 1976. The Tucson demonstration was conducted in an existing two-lane facility that forms a component of the State vehicular emission control program.

The demonstration was conducted with two volunteer groups, a treatment and a control group. Both groups received essentially the same comprehensive diagnostic inspection.** The control group, however, received only pass/fail information while the treatment group received a detailed report on the inspection results. Participants returning for after-repair inspection were counseled on the quality of the repair.

The diagnostic inspection included loaded mode emissions testing; engine tuning analysis; dynamic brake testing using a dynamometer; wheel alignment readings of caster, camber and toe angles; instrumented testing of headlight aim; and visual inspection of underhood, underchassis, interior and exterior subsystems and components.

4. Vehicle Types Inspected: The vehicles for the demonstration project were drawn from passenger cars of 1968 to 1973 make/model sets selected by NHTSA. The vehicles included different weight class vehicles of the United States manufacturers (American Motors,

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* Also sponsored by the State of Arizona; each state contributed at least 10 percent matching funds, per the Act, though it did not have to be directly in cash.

** Treatment group was inspected for some engine/electrical analysis items that control group was not inspected for.

[redacted]

Chrysler, Ford, General Motors) and popular imports (Datsun, Toyota, Volkswagen).

5. Types of Inspection Services: The inspections given on a voluntary basis included:

   - Brakes - roller brake testing using a low speed brake dynamometer; visual inspection of brake components by pulling two wheels
   - Exhaust emissions - idle and loaded mode testing for HC and CO levels, condition of exhaust system and components
   - Engine analysis - engine tuning checking timing pattern, engine RPM, dwell angle, engine advance, secondary ignition
   - Wheel alignment - automated instrument dynamic reading of caster, camber and toe angles
   - Steering/suspension - visual inspection of ball joints, tie rods, shock absorbers, springs, and energy absorbing steering column
   - Drivetrain - visual inspection of U-joints only
   - Lights - headlight aim inspection by instrument, and visual inspection of brake lights, directional lights, rear lights and side marker lights
   - Interior - visual inspection of seats, head restraints, rear view mirror, horn, windshield wiper and washer, speedometer, transmission shift lever and indicator
   - Body/chassis - visual inspection of frame, bumpers, doors, fenders, glazing, outside mirror, hood, latches and locks, gas filler cap
   - Reinspection of all failed components.

6. Hours of Operation: 8:00 a.m. to 5:00 p.m. Monday through Friday.

7. Physical Area of Inspection Facility: The Tucson inspection facility contained two inspection lanes, a bay and some office areas,and was housed in an area of approximately 6,500 square feet. A trailer having an area of approximately 1,000 square feet was used as a participant waiting area and inspection crew quarters. The facility was on a three-acre lot approximately four miles southeast of the City of Tucson on a major north-south road which leads to the City.

8. Inspection Station Dimensions: The dimensions of the facility included:

   - The two lanes: approximately 4,400 square feet
   - Bay area: approximately 750 square feet
   - Customer waiting area: approximately 290 square feet.

9. Number of Lanes/Bays: The facility had two lanes and one bay.

10. Lane/Bay Dimension: Each lane was 20' wide x 110' long and the bay is 25' wide x 30' long.

11. Queueing Area: A designated reserved area was set aside for the participants as a queueing area. An inspector received the vehicle key from the lane clerk after the motorist logged in.

12. Parking Area: The facility's 13,600 square-foot-parking area could accommodate approximately 60 vehicles.

13. Facility Diagram and Location of Equipment: Figure 1 is a plan of the entire inspection property area. Figure 2 is a floor plan of one of the two inspection lanes, indicating the layout of the major inspection equipment. Figure 3 is a floor plan of the bay area, also indicating the location of inspection equipment. Figure 4 is a floor plan of the portable office in which space was allocated for a waiting room area.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: The facility was constructed in 1973 as a component of the State vehicular emissions control program.

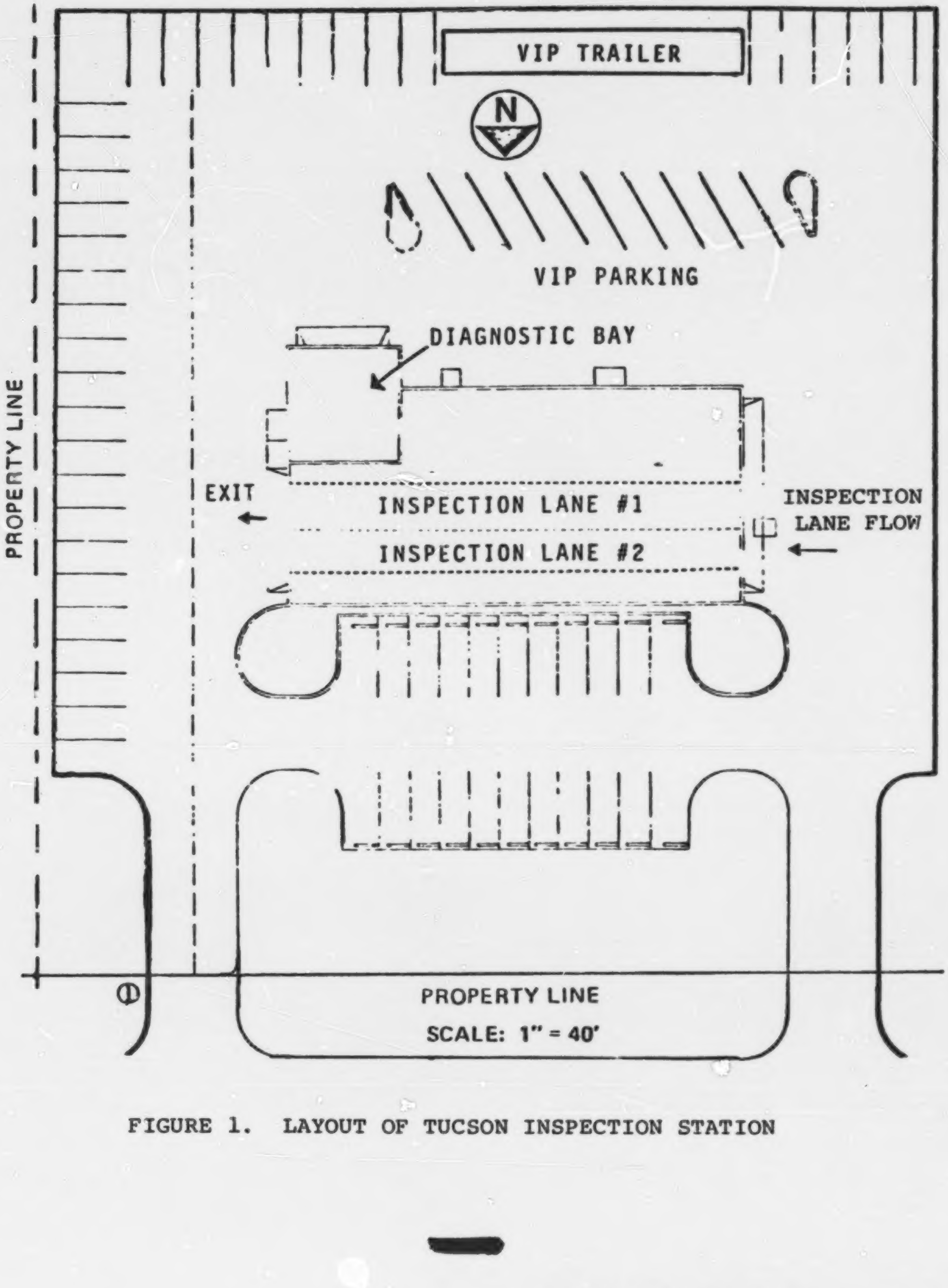

VIP TRAILER
N
VIP PARKING
DIAGNOSTIC BAY
EXIT
INSPECTION LANE #1
INSPECTION LANE #2
INSPECTION LANE FLOW
PROPERTY LINE
PROPERTY LINE
①
SCALE: 1" = 40'

FIGURE 1. LAYOUT OF TUCSON INSPECTION STATION

BEST DOCUMENT AVAILABLE

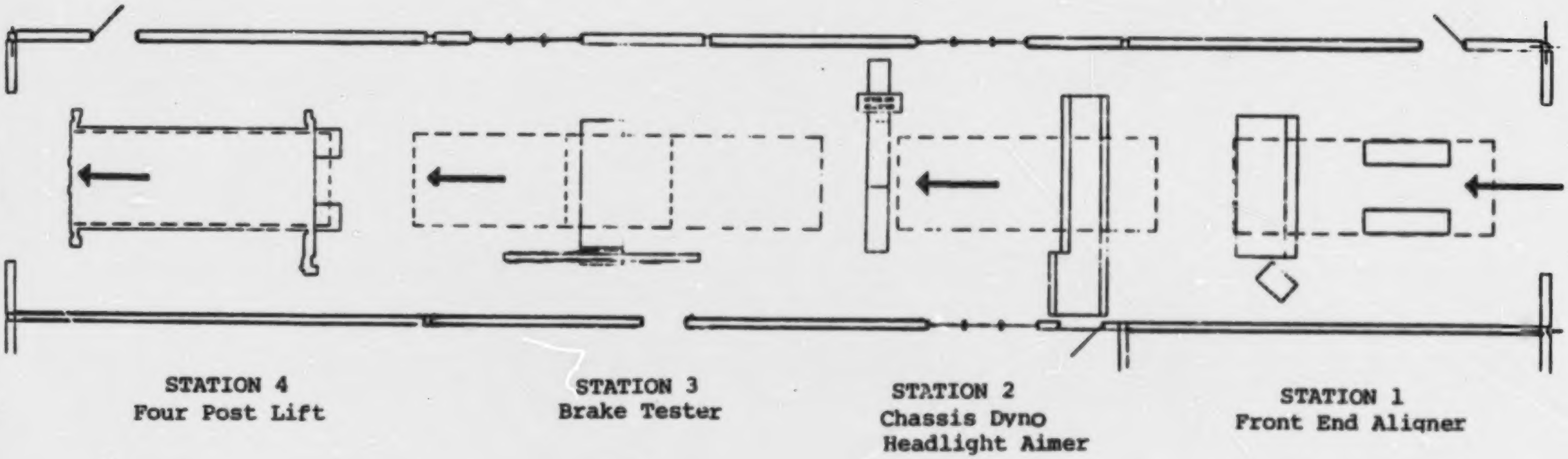

STATION 4
Four Post Lift
STATION 3
Brake Tester
STATION 2
Chassis Dyno
Headlight Aimer
STATION 1
Front End Aligner

FIGURE 2. INSPECTION LANE FLOOR PLAN

BEST DOCUMENT AVAILABLE

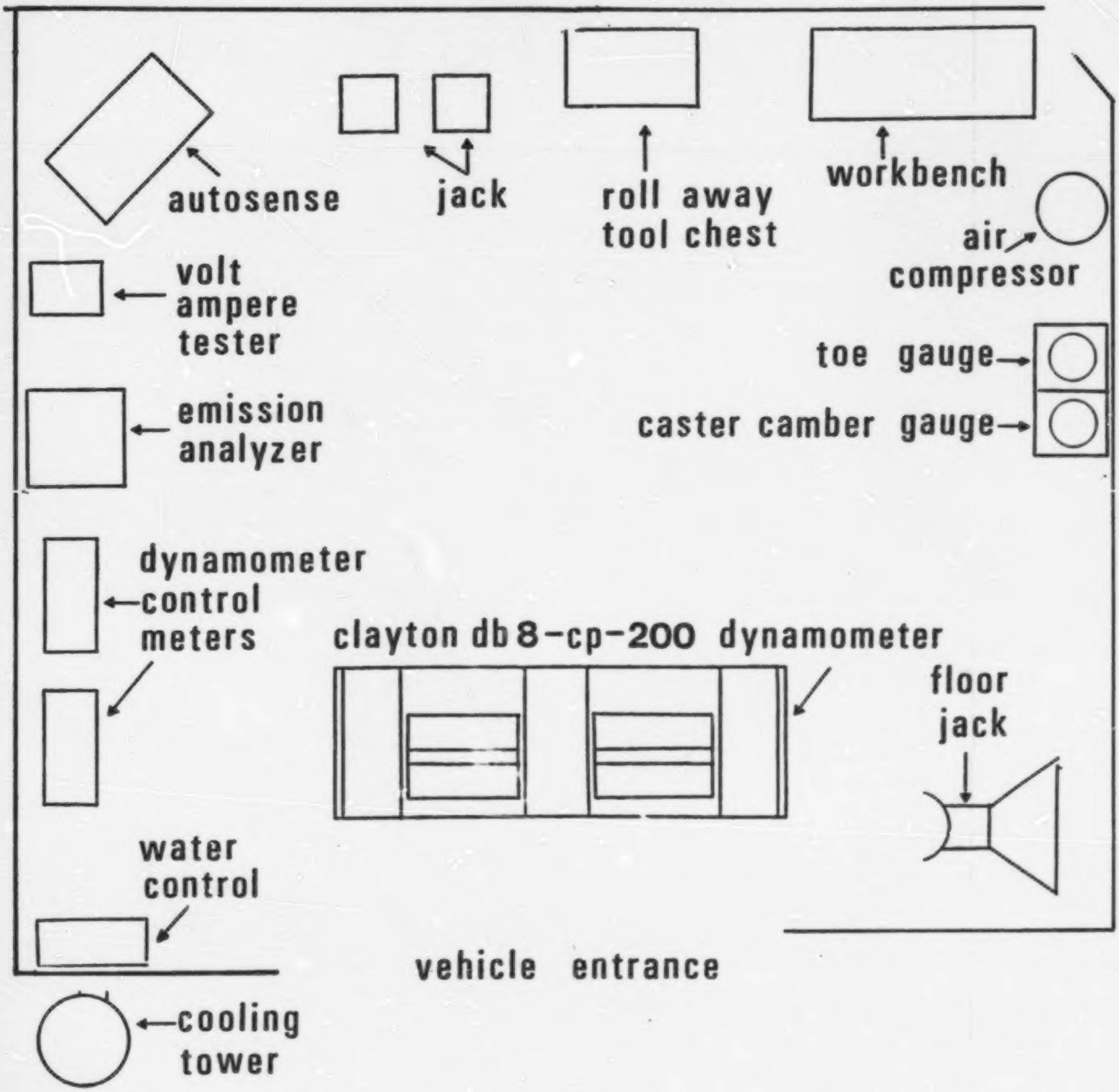

autosense
jack
roll away tool chest
workbench
air compressor
volt ampere tester
toe gauge
caster camber gauge
emission analyzer
dynamometer control meters
clayton db 8-cp-200 dynamometer
floor jack
water control
vehicle entrance
cooling tower

FIGURE 3. FLOOR PLAN OF THE BAY AREA

BEST DOCUMENT AVAILABLE

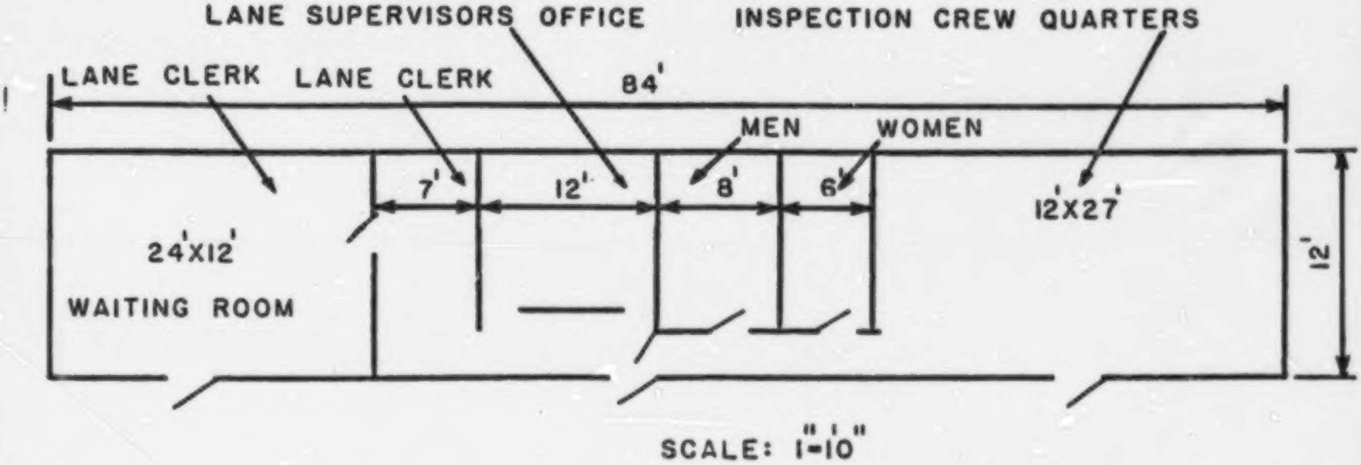


FIGURE 4. FLOOR PLAN OF PORTABLE OFFICE

2. Construction Type and Material: The one-story building was constructed of concrete block.

3. Patron Accommodations in Addition to Lanes: A 24'x12' waiting room, large enough for about 18 people, was made available in a trailer adjacent to the inspection area. The waiting room was equipped with sofas and lounge chairs, magazines and current reading materials. Coffee, soft drinks and snack-dispensing machines were available for the participants' use.

4. Ventilation System Design: Two blowers were installed in the roof above each lane. The inlet ducts were at both ends of each lane at floor level to permit good air circulation.

5. Safety Accommodations: A fire-rated wall provided area separation in accordance with local codes between the lanes and office areas. The VIP clients' waiting room was separated from the inspection area to minimize noise and emmissions pollution.

6. Noise Accomodations: No special equipment.

III. STEPS OF INSPECTION PROCESS

1. Check-In: Motorist interfaced with lane clerk (one for each lane) who (1) checked appointment calendar, (2) checked inspection/reinspection requirements, (3) collected maintenance data, (4) filled out inspection form header, (5) obtained keys from owner and provided vehicle, keys and inspection form to the inspector.

BEST DOCUMENT AVAILABLE

2. Test Sequence:

- Station 1 - Body interior, exterior, lights and electrical visual inspection, power brake vacuum booster checked, wheel alignment inspection.
- Station 2 - Emission test in three modes (high cruise, low cruise and idle), headlight aim inspection, engine tuning.
- Station 3 - Front and rear service brakes and parking brakes tested for braking force.
- Station 4 - Underbody, suspension, steering, tires, wheels, and brakes inspected on lift, review of inspection results by counselor.
- (Treatment Group Only) - If desired, additional diagnostic inspection provided in the event of emission failure. The additional inspections were conducted in the bay.
- Reinspections were normally conducted in the bay.

3. Data Handling: Manual - Figure 5 is a copy of the form filled out and given to the participant.

4. Check-Out: The control group participant received pass/fail information only. The treatment group participant received an explanation of the test results and counseling on needed repair. In the event of emissions failure, the treatment group participant was provided with additional diagnostic testing (in the bay) if he desired.

IV. FEE

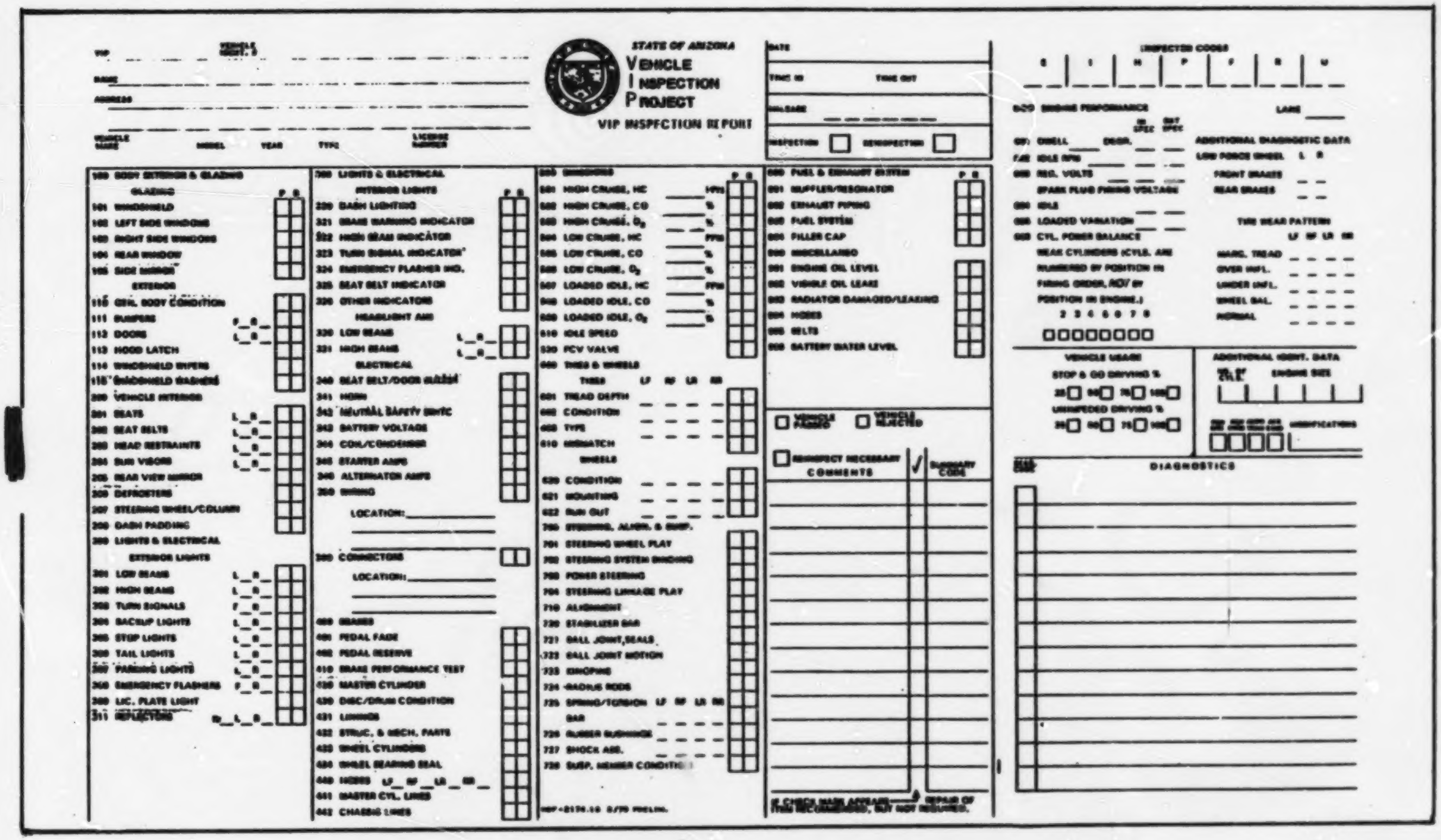
1. Diagnostic Inspection: The diagnostic inspection was free to the participants in this program.

2. Other Services: If needed, tires were properly inflated. If easily corrected, the headlights were properly aimed. Both services were occasionally provided(free of charge).

V. TEST EQUIPMENT

1. Brakes: Each lane contained a low speed brake dynamometer, Hofman Brekon I,which permitted dynamic brake testing. A Clayton DB-CP-200 brake/chassis dynamometer was available in the bay area for reinspection.

2. Alignment: Each lane contained a Hunter F-60 to read the caster, camber and toe angle. A caster-camber gauge and a toe gauge were available in the bay area for reinspection.



STATE OF ARIZONA
VEHICLE
INSPECTION
PROJECT
VIP INSPECTION REPORT

VIP ____ VEHICLE IDENT. # ____
NAME ____
ADDRESS ____
VEHICLE MAKE ____ MODEL ____ YEAR ____ TYPE ____ LICENSE NUMBER ____

DATE ____
TIME IN ____ TIME OUT ____
MILEAGE ____
INSPECTION ☐ REINSPECTION ☐

INSPECTOR CODES
E | I | H | P | F | R | U

100 BODY EXTERIOR & GLAZING
GLAZING (P R)
101 WINDSHIELD ☐☐
102 LEFT SIDE WINDOWS ☐☐
103 RIGHT SIDE WINDOWS ☐☐
104 REAR WINDOW ☐☐
105 SIDE MIRROR ☐☐
EXTERIOR
110 GEN. BODY CONDITION ☐☐
111 BUMPERS F__ R__ ☐☐
112 DOORS L__ R__ ☐☐
113 HOOD LATCH ☐☐
114 WINDSHIELD WIPERS ☐☐
115 WINDSHIELD WASHERS ☐☐
200 VEHICLE INTERIOR
201 SEATS L__ R__ ☐☐
202 SEAT BELTS L__ R__ ☐☐
203 HEAD RESTRAINTS L__ R__ ☐☐
204 SUN VISORS L__ R__ ☐☐
205 REAR VIEW MIRROR ☐☐
206 DEFROSTERS ☐☐
207 STEERING WHEEL/COLUMN ☐☐
208 DASH PADDING ☐☐
300 LIGHTS & ELECTRICAL
EXTERIOR LIGHTS
301 LOW BEAMS L__ R__ ☐☐
302 HIGH BEAMS L__ R__ ☐☐
303 TURN SIGNALS F__ R__ ☐☐
304 BACKUP LIGHTS L__ R__ ☐☐
305 STOP LIGHTS L__ R__ ☐☐
306 TAIL LIGHTS L__ R__ ☐☐
307 PARKING LIGHTS L__ R__ ☐☐
308 EMERGENCY FLASHERS F__ R__ ☐☐
309 LIC. PLATE LIGHT ☐☐
311 REFLECTORS Fr__ L__ R__ ☐☐

300 LIGHTS & ELECTRICAL
INTERIOR LIGHTS (P R)
320 DASH LIGHTING ☐☐
321 BRAKE WARNING INDICATOR ☐☐
322 HIGH BEAM INDICATOR ☐☐
323 TURN SIGNAL INDICATOR ☐☐
324 EMERGENCY FLASHER IND. ☐☐
325 SEAT BELT INDICATOR ☐☐
326 OTHER INDICATORS ☐☐
HEADLIGHT AIM
330 LOW BEAMS L__ R__ ☐☐
331 HIGH BEAMS L__ R__ ☐☐
ELECTRICAL
340 SEAT BELT/DOOR BUZZER ☐☐
341 HORN ☐☐
342 NEUTRAL SAFETY SWITC ☐☐
343 BATTERY VOLTAGE ☐☐
344 COIL/CONDENSER ☐☐
345 STARTER AMPS ☐☐
346 ALTERNATOR AMPS ☐☐
350 WIRING ☐☐
LOCATION: ____
360 CONNECTORS ☐☐
LOCATION: ____
400 BRAKES
401 PEDAL FADE ☐☐
402 PEDAL RESERVE ☐☐
410 BRAKE PERFORMANCE TEST ☐☐
420 MASTER CYLINDER ☐☐
430 DISC/DRUM CONDITION ☐☐
431 LININGS ☐☐
432 STRUC. & MECH. PARTS ☐☐
433 WHEEL CYLINDERS ☐☐
434 WHEEL BEARING SEAL ☐☐
440 HOSES LF__ RF__ LR__ RR__ ☐☐
441 MASTER CYL. LINES ☐☐
442 CHASSIS LINES ☐☐

500 EMISSIONS (P R)
501 HIGH CRUISE, HC ____ PPM ☐☐
502 HIGH CRUISE, CO ____ % ☐☐
503 HIGH CRUISE, O_2 ____ % ☐☐
504 LOW CRUISE, HC ____ PPM ☐☐
505 LOW CRUISE, CO ____ % ☐☐
506 LOW CRUISE, O_2 ____ % ☐☐
507 LOADED IDLE, HC ____ PPM ☐☐
508 LOADED IDLE, CO ____ % ☐☐
509 LOADED IDLE, O_2 ____ % ☐☐
510 IDLE SPEED ☐☐
520 PCV VALVE ☐☐
600 TIRES & WHEELS
TIRES LF RF LR RR
601 TREAD DEPTH __ __ __ __ ☐☐
602 CONDITION __ __ __ __ ☐☐
603 TYPE __ __ __ __ ☐☐
610 MISMATCH ☐☐
WHEELS
620 CONDITION __ __ __ __ ☐☐
621 MOUNTING __ __ __ __ ☐☐
622 RUN OUT __ __ __ __ ☐☐
700 STEERING, ALIGN. & SUSP.
701 STEERING WHEEL PLAY ☐☐
702 STEERING SYSTEM BINDING ☐☐
703 POWER STEERING ☐☐
704 STEERING LINKAGE PLAY ☐☐
710 ALIGNMENT ☐☐
720 STABILIZER BAR ☐☐
721 BALL JOINT, SEALS ☐☐
722 BALL JOINT MOTION ☐☐
723 KINGPINS ☐☐
724 RADIUS RODS ☐☐
725 SPRING/TORSION BAR LF RF LR RR ☐☐
726 RUBBER BUSHINGS __ __ __ __ ☐☐
727 SHOCK ABS. __ __ __ __ ☐☐
728 SUSP. MEMBER CONDITION ☐☐
[illegible]-2174.10 8/75 PRELIM.

800 FUEL & EXHAUST SYSTEM (P R)
801 MUFFLER/RESONATOR ☐☐
802 EXHAUST PIPING ☐☐
803 FUEL SYSTEM ☐☐
804 FILLER CAP ☐☐
900 MISCELLANEOUS
901 ENGINE OIL LEVEL ☐☐
902 VISIBLE OIL LEAKS ☐☐
903 RADIATOR DAMAGED/LEAKING ☐☐
904 HOSES ☐☐
905 BELTS ☐☐
906 BATTERY WATER LEVEL ☐☐

☐ VEHICLE PASSED ☐ VEHICLE REJECTED
☐ REINSPECT NECESSARY

COMMENTS	✓	SUMMARY CODE

IF CHECK MARK APPEARS → REPAIR OF ITEMS RECOMMENDED, BUT NOT REQUIRED.

820 ENGINE PERFORMANCE LANE ____
IN SPEC OUT SPEC
821 DWELL ____ DEGR. __ __
822 IDLE RPM ____ __ __
823 REG. VOLTS __ __ __
SPARK PLUG FIRING VOLTAGE
824 IDLE __ __
825 LOADED VARIATION __ __
826 CYL. POWER BALANCE
WEAK CYLINDERS (CYLS. ARE NUMBERED BY POSITION IN FIRING ORDER, NOT BY POSITION IN ENGINE.)
1 2 3 4 5 6 7 8
☐☐☐☐☐☐☐☐

ADDITIONAL DIAGNOSTIC DATA
LOW FORCE WHEEL L R
FRONT BRAKES __ __
REAR BRAKES __ __
TIRE WEAR PATTERN LF RF LR RR
MARG. TREAD __ __ __ __
OVER INFL. __ __ __ __
UNDER INFL. __ __ __ __
WHEEL BAL. __ __ __ __
NORMAL __ __ __ __

VEHICLE USAGE
STOP & GO DRIVING %
25☐ 50☐ 75☐ 100☐
UNIMPEDED DRIVING %
25☐ 50☐ 75☐ 100☐

ADDITIONAL IDENT. DATA
NO. OF CYLS. ENGINE SIZE
☐☐☐☐ MODIFICATIONS

DIAG. CODE DIAGNOSTICS

FIGURE 5. VEHICLE INSPECTION PROJECT INSPECTION CHECKLIST

BEST DOCUMENT AVAILABLE

3. Headlight Aim: Each lane contained a Bear 561 to read headlight aim.

4. Lift: Each lane contained a Stewart Warner four-post lift. Floor jacks were available in the bay for lifting.

5. Emission Analysis: Each lane contained a Beckman 590 with O_2 meter for emissions analysis. More in-depth analysis of emissions and engine tuning was available in the bay area (but was infrequently used).

6. Engine Analysis: Each lane contained a Sun Electric TUT-915R engine analyzer to inspect engine ignition firing patterns, RPM, etc. The Clayton DB-CP-200 was also used for engine analysis.

7. Dynamometer: Each lane contained a Clayton DB-CP-200 chassis dynamometer to permit loaded emissions and engine tuning analysis under simulated speeds.

8. Noise Testing: None.

9. Fuel Economy: None.

10. Backup: The redundancy of equipment normally permitted backup until repair of down equipment.

11. Technical Library: While no area was designated as a library, a collection of service manuals published by Chilton and by the vehicle manufacturers was available for reference.

12. Mobile Equipment: None.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance:

Equipment	Maintenance Schedule
. Wheel Alignment Tester	a) clean, daily b) lubricate, monthly
. Brake Dynamometer	a) clean, lubricate semi-annually
. Chassis Dynamometer	a) clean, daily b) check hoses, belts, monthly
. Emissions and Tuning - Autosense	a) air filter, daily b) clean tape head, monthly
. Tune-up Tester	a) not defined
. Regulator Alternator Tester	a) not defined
. Headlight Tester	a) weekly

[redacted]

2. Frequency of Equipment Calibration:

Equipment	Calibration Schedule
Wheel Alignment Tester F-60	a) quick check - weekly b) calibration - monthly
Brake Dynamometer Hofmann Brekon I	a) monthly
Chassis Dynamometer Clayton CT-200	a) monthly
Emissions and Tuning HTS Autosense	a) emissions cal.-monthly
Tune-up Tester Sun TUT-915-R	a) monthly
Regulator Alternator Tester Sun VAT 28	a) monthly
Headlamp Tester - Bear 561	a) weekly

VII. FACILITY STAFFING

Counting only the operational staff of the Tucson staff directly involved in the inspection process rather than recruitment, program analysis, etc., the staff complement included:

- One test station supervisor
- Two lane supervisors
- Fourteen senior technicians
- Eight technicians
- One equipment calibration/maintenance technician
- Two lane clerks.

VIII. TRAINING

1. Staff Experience:

   - Supervision experience - Technician with a minimum of five years of automobile mechanic experience
   - Inspector experience - Technician with a minimum of three years of automotive mechanic experience.

2. Employee Training: The initial staff training included 156 hours of classroom training on the inspection equipment and procedures. This was later modified to 16 hours of classroom training and 24 hours of on-the-job training. This in-house training was supplemented by periodic training (on the test instruments) by the equipment manufacturers' representatives.

IX. QUALITY CONTROL*

1. Contractor Monitoring: The state program staff monitored the activities of the Hamilton Standard subcontracted inspectors (inspections, fill-out of forms, calibration, and maintenance process and schedule).

2. Supervision of Inspectors: A lane supervisor continuously monitored the activities of the inspectors in his lane.

3. Survey of Customer Satisfaction: Two different survey methods were implemented:

   - At reinspection, the motorist was asked to fill out a questionnaire which permitted him to express his reaction to the VIP and the impact of the diagnostic form on the repair facility.
   - In order to measure support from the voluntary participants, four waves of survey questionnaires were mailed out to solicit information on participant reaction to the program and the reaction of the repair industry. In general, the reactions were favorable.

4. Criteria for Failure: Existing State or local standards, Federal VIU standards, or manufacturer tolerances were used.

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* In addition to the measures cited in this section, all projects were monitored through on-site visits and reviews of procedures and documentation by a Technical Support contractor reporting to NHTSA. Visits were monthly until September 1975, then reduced to quarterly.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Initially the participants were asked to return in ten days. To minimize inconvenience this was later modified to 30 days. To minimize participant dropout in this voluntary program, the 30-day requirement was relaxed to coming back at the participants' discretion.

XI. CUSTOMER INTERFACE

1. Counseling: Although both the treatment and the control group were provided with a form describing the condition of subsystems and components, more information was provided to the treatment group. The inspector conducting the counseling advised the treatment group on potential remedies. He did not, however, estimate the cost of repair or make recommendations as to which repair facility to use.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: Approximately 27 minutes.
2. Time at Each Station in the Lane:
   - Station 1 - 10.1 minutes average
   - Station 2 - 5.3 minutes average
   - Station 3 - 3.1 minutes average
   - Station 4 - 8.2 minutes average
   - Total: 26.7 minutes average
3. Theoretical Maximum Lane Throughput: Approximately 61 vehicles/lane/day.
4. Average Lane Throughput: 48.6 vehicles/lane/day.
5. Appointments Used: Yes.

XIII. CONSUMER AND COMMUNITY RELATIONS

The VIP program utilized an advertising campaign to make the program known to the general public. The VIP also worked through an informal project advisory committee to obtain community support and reaction. The committee was made up of representatives of:

[redacted]

- The Department of Health Services
- The Department of Transportation
- Office of the Governor's Highway Safety Coordinator
- Independent Garage Owners Association
- American Automobile Association
- New Car Dealers Association.

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment
    - Facility
        - Structure: $203,000
        - Land and Improvements: $60,000.
    - Equipment
        - Major equipment in two lanes and bay: $105,230
        - Small tools: $5,000 (approximately).
2. Average Hourly Labor Rates (1975-1976)
    - Supervisory and Administrative Rates
        - Lane Supervisor: $5.01/hour
        - Site Supervisor: $7.75/hour
        - Staff Secretaries: $3.85/hour
    - Labor Rates
        - Senior Inspector: $4.38/hour
        - Inspector: $4.00/hour
        - Diagnostician: $4.76/hour
    - Maintenance and Quality Control
        - Maintenance Mechanic - $6.56/hour
        - Quality Control - $6.04/hour.

DIAGNOSTIC DEMONSTRATION PROJECT
CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: District of Columbia Motor
Vehicle Diagnostic Inspection Demonstration Project
1001 Half Street, S.W.
Washington, D.C. 20024

2. Contact Name and Number: Roy Dennison, 755-1651
Robert Kozak, 727-5779

3. General Description of Facility: A vehicle diagnostic inspection demonstration was conducted between April 14, 1975 and June 30, 1976 using two volunteer groups: a treatment group receiving a full diagnostic inspection and a control group receiving the standard D.C. motor vehicle safety inspection. Each group was to participate in three inspection cycles. During each cycle repair and maintenance data were collected for analysis. The number of participants in the three cycles were:

- First cycle - 3,559 in the treatment group; 2,902 in the control group.
- Second cycle - 1,878 in the treatment group; 1,455 in the control group.
- Third cycle - 346 in the treatment group; 5 in the control group. (This cycle was restricted by time.)

The full diagnostic inspection included dynamic brake testing using both a brake dynamometer and a platform brake tester -- as well as visual brake inspection by pulling two wheels -- engine tuning analysis, emissions testing, dynamic analysis of wheel alignment, and headlamp testing by instrumentation. The instrumented inspection was augmented by visual inspection of underhood and undercarriage subsystems, as well as inspection of glazing, lamps, horn, interior and exterior components. The D.C. diagnostic inspection demonstration project utilized one lane of a four-lane station operated by the city for its periodic mandatory vehicle inspection (PMVI) program.

[redacted]

4. Vehicle Types Inspected: The volunteers for the demonstration were drawn from passenger cars of six make/model designations for model years 1968-1973. The six/make/model sets were:

    - Chevrolet Impala, BelAir, Caprice, Biscayne
    - Ford Custom, Galaxie, LTD
    - Volkswagen
    - Plymouth Valiant, Dodge Dart
    - Plymouth Fury, Chrysler Newport, Chrysler New Yorker, Dodge Polaris, Dodge Monaco
    - Cadillac (except Eldorado), Oldsmobile 98 (except Toronado), Buick Electra.

5. Types of Inspection Services: Inspections included:

    - Brakes - roller brake test using a dynamometer, platform brake test, visual inspection of brake material by pulling two wheels
    - Engine analysis - cylinder balance, ignition primary, ignition secondary, point dwell, start current draw, charging action
    - Wheel alignment - side slip measurement using scuff gauge, automatic instrument reading of caster, camber, toe angles
    - Exhaust emissions - loaded mode testing for HC and CO levels, condition of exhaust system and components
    - Steering/suspension - visual inspection of shock absorbers and energy-absorbing steering columns, springs, ball joints, tie rods
    - Tires and wheels - visual inspection of tire and wheel condition
    - Drive Train - visual inspection of differential (leaks) and drive shaft
    - Interior - visual inspection of seats, head restraints, rear view mirror, horn, windshield wipers and washer, speedometer, transmission shift lever and indicator, defroster/defogger

- Lights - Headlamp aim inspection by instrument, and visual inspection of directional signals, brake lights, stop lamps, reverse lights and side marking lights

- Body/chassis - visual inspection of bumpers, frame, doors, fenders, glazing, outside mirror, hood, latches and locks, gas filler cap.

- Reinspection of all components available at no charge.

6. Hours of Operation: The hours for the diagnostic lane used by the treatment group were 7:30 a.m. to 4:00 p.m. Monday through Friday. The hours for the dedicated lane used for the control group were: 7:30 a.m. to 4:00 p.m. Monday to Saturday and 5:00 p.m. to 7:00 p.m. Saturday to induce volunteers into the control group by giving them after-work and weekend hours of inspection. These hours were not available to the general public required to obtain PMVI, and had the effect of minimizing waiting time for the control group.

7. Physical Area of Inspection Facility: The facility, which included four inspection lanes, staff office, rest rooms, and a records office, was approximately 17,800 square feet in area. The facility sat on an approximately 74,000 square-foot-lot. Two 50-foot trailers were added on the lot to provide office and waiting room space for the diagnostic demonstration project. A 30-foot trailer was added for use as staff quarters.

8. Inspection Station Dimensions: The dimensions of each inspection lane, one of which was used for diagnostic inspection, were 18 feet wide by 159 feet long. Approximately 10,000 square feet of the facility's 17,800 square feet was used for the inspection lanes. The remaining area included aisle space, office and restroom space.

9. Number of Lanes/Bays - One of four lanes was dedicated to diagnostic inspection.

10. Lane/Bay Dimensions: 18 feet wide x 159 feet long were the dimensions for each of the four lanes.

11. Queueing Area: A special parking area was set aside for the treatment group, to differentiate them from the motorists waiting for regular PMVI inspection.

12. Facility Diagram and Location of Equipment: Figure 1 is a site plan of the D.C. facility. Figure 2 illustrates the layout of equipment in the diagnostic lane.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: The diagnostic lane was designed in 1973 under a multiyear contract with the U.S. Department of Transportation (NHTSA) for engineering development work. It became operational in March 1974. Automated data processing equipment was operational by September 1974.

2. Construction Type and Material: The inspection station used was a single-level brick building with steel columns and roof structure built in 1959. The floor was steel-reinforced concrete on pilings. The roof was a concrete slab with gravel coating.

3. Patron Accommodations: Two 50-foot rented trailers were used as reception and waiting area for patrons as well as offices for the staff. Rest rooms were located off the diagnostic lane. For customer comfort, coffee was provided and reading material was made available.

4. Health/Safety/Noise Accommodations: The position for emissions testing and engine analysis where noise and pollution would be highest was located at the facility entrance to direct the noise and pollution out of the building. The dynamometer was equipped with sound deadening rolls.

III. STEPS OF INSPECTION PROCESS

1. Check-In - Participant came to the facility on a scheduled basis and provided the facility with a maintenance log, fuel use records, and repair bills.

2. Test Sequence (for treatment group):

   - Station 1 - Log in car, attach engine harness, measure tire pressure (and correct, if necessary), check fluid reservoir levels, conduct dynamic brake analysis, emissions test, engine analysis, headlight performance, speedometer operation, interior structure inspection.

   - Station 2 - Scuff test, under-vehicle inspection of tires, steering and suspension, exhaust system and drivetrain, visual inspection of one front and one rear brake system (wheel pull).

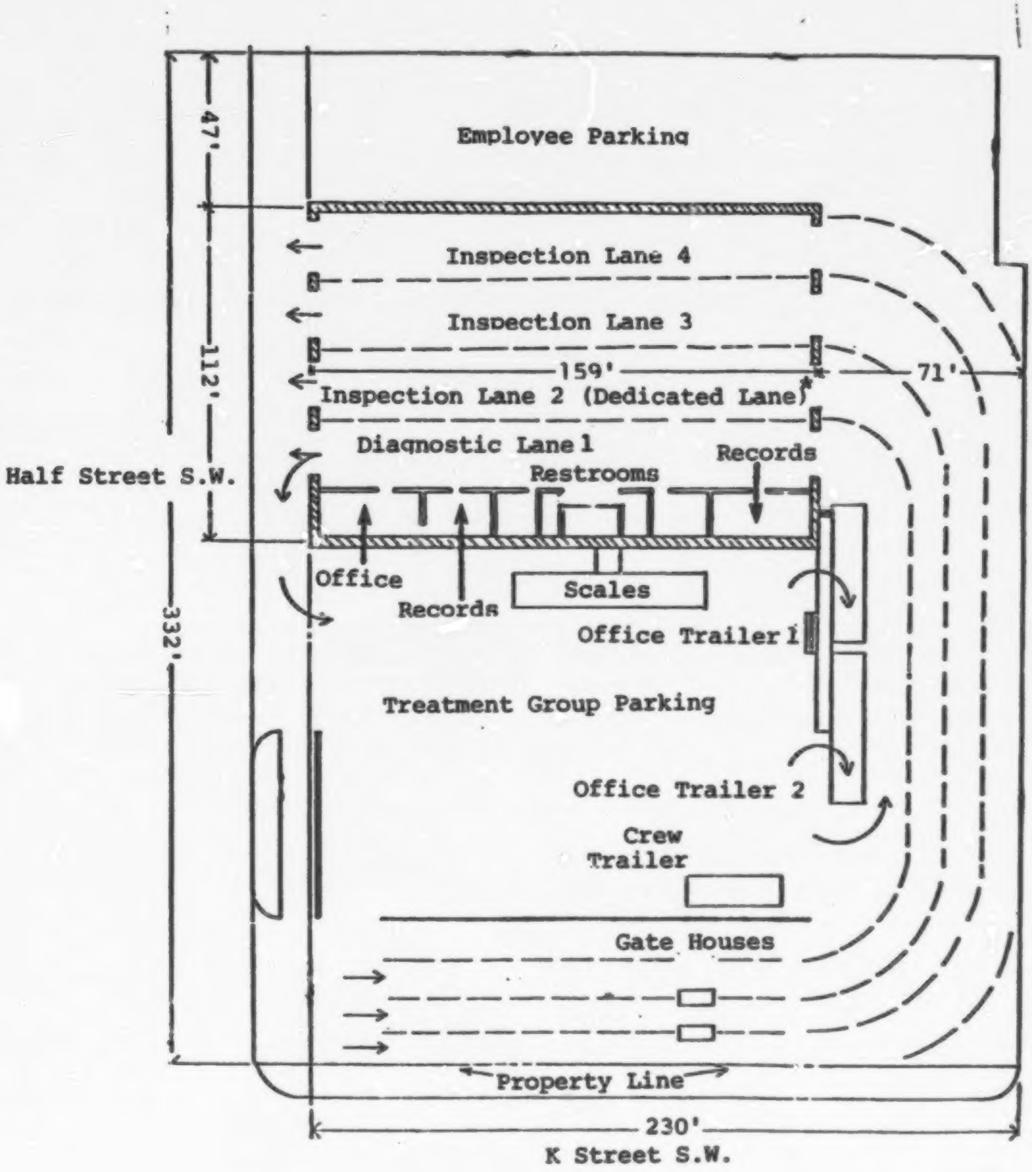
Employee Parking
Inspection Lane 4
Inspection Lane 3
Inspection Lane 2 (Dedicated Lane)*
Diagnostic Lane 1
Records
Restrooms
Office
Records
Scales
Office Trailer 1
Treatment Group Parking
Office Trailer 2
Crew Trailer
Gate Houses
Property Line
Half Street S.W.
K Street S.W.
47'
112'
332'
159'
71'
230'

FIGURE 1. SITE PLAN OF WASHINGTON, D.C. INSPECTION STATION

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* For project control group.

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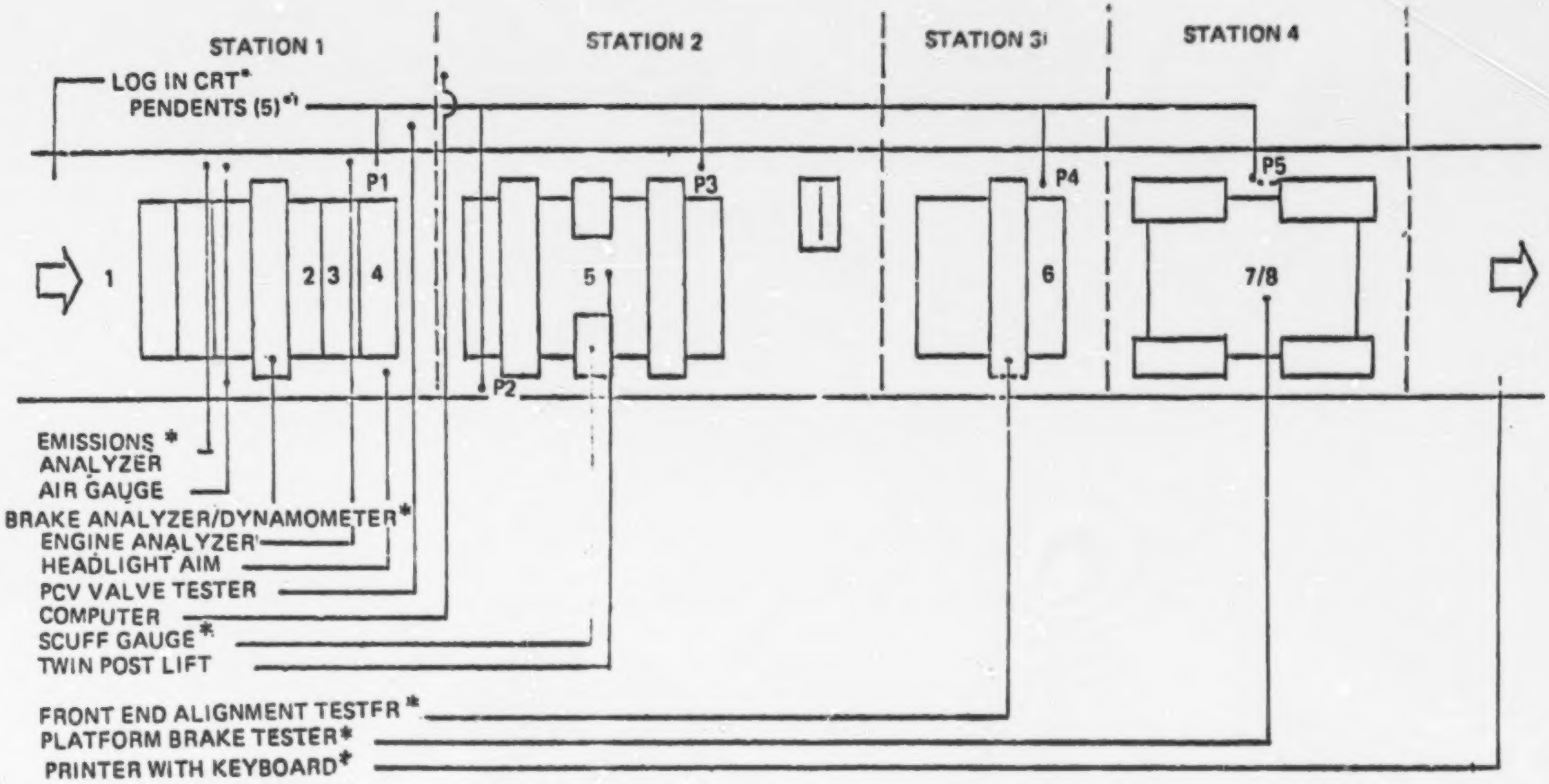

STATION 1
STATION 2
STATION 3
STATION 4
LOG IN CRT*
PENDENTS (5)*
P1
P2
P3
P4
P5
1
2
3
4
5
6
7/8
EMISSIONS * ANALYZER
AIR GAUGE
BRAKE ANALYZER/DYNAMOMETER*
ENGINE ANALYZER
HEADLIGHT AIM
PCV VALVE TESTER
COMPUTER
SCUFF GAUGE*
TWIN POST LIFT
FRONT END ALIGNMENT TESTER*
PLATFORM BRAKE TESTER*
PRINTER WITH KEYBOARD*

*DENOTE DIRECT COMPUTER INTERFACE.

FIGURE 2. EQUIPMENT LOCATION AND TRAFFIC FLOW PLAN IN THE WASHINGTON, D.C. DIAGNOSTIC INSPECTION LANE

- **Station 3** - Dynamic wheel alignment inspection, visual inspection of auxiliary lighting and reflectors.

- **Station 4** - Visual inspection of exterior vehicle structures, glazing, doors, platform braking examination.

3. Data Handling: The results of each inspection were entered into a computer data storage system. Where possible, the inspection instrument was directly linked to enter the inspection result into the automated process. Where this was not possible, it was entered into the computer by the inspector via a terminal (pendant) located at each of the inspection stations. The motorist was provided a printout of these results. In the event of system failure, a manual form (Figure 3) was used.

4. Check-Out: At the completion of the inspection, the reject items and the "advise" items (degraded components or subsystems considered conditional) on the printout form were discussed with the patron.

IV. FEES

1. Diagnostic Inspection: The diagnostic inspection was free to the volunteers in this program.

2. Other Services: If needed, the tires were properly inflated using Bosch portable pressure tanks with gauges. Headlamp aim was rarely corrected. Both services, when provided, were free of charge.

V. TEST EQUIPMENT

1. Brakes

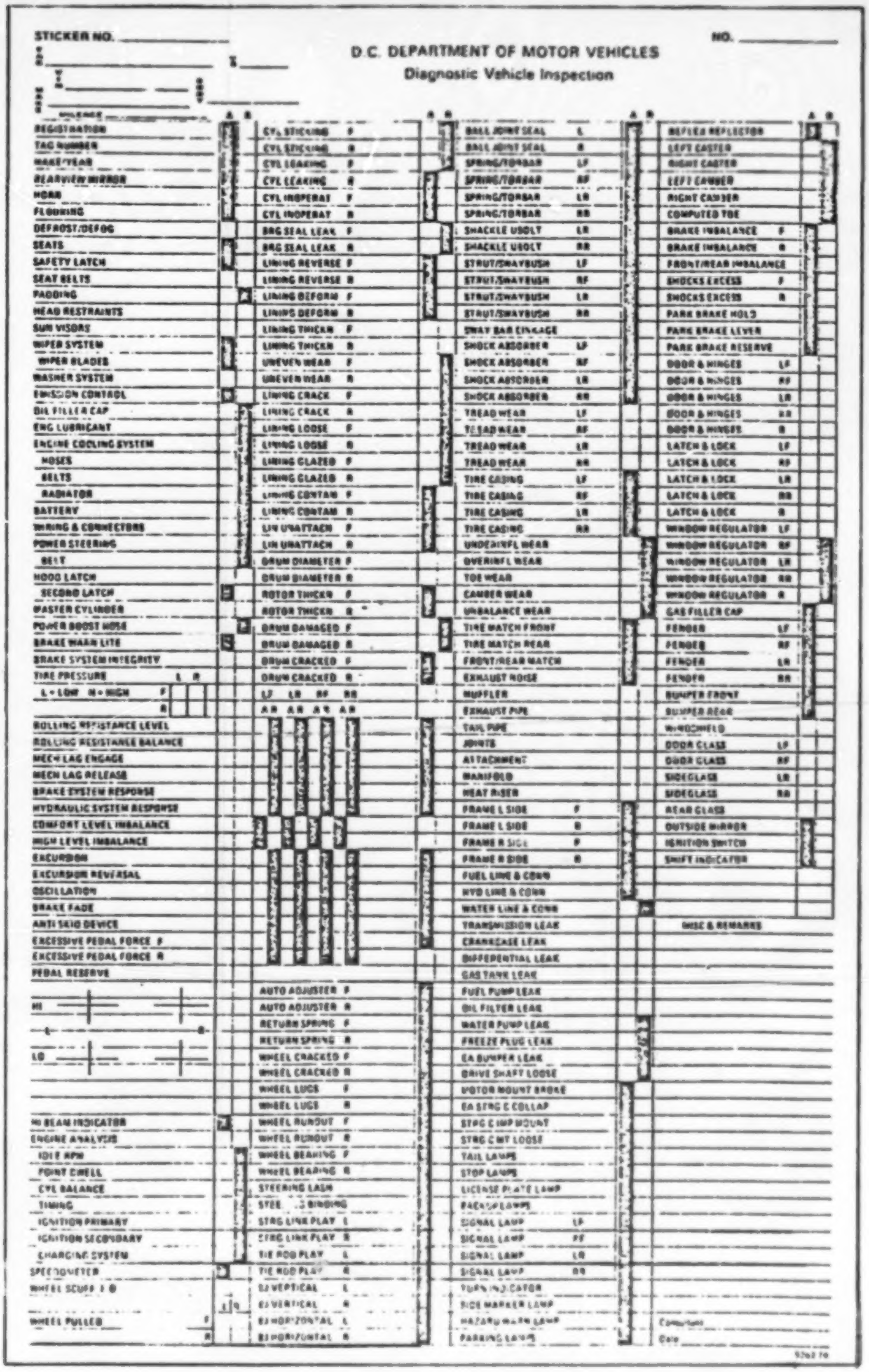
   - Combination Dynamometer/Brake Analyzer-Clayton Model DB-8-CP-200

   - Computerized Brake System Analyzer-Clayton Model SP511

   - Platform Brake Tester - Weaver Model WJ-751-7.

2. Alignment

   - Hunter Model F-60
   - Scuff Tester - Weaver Scuff Gauge WY 27A.



STICKER NO. ____________

NO. ____________

D.C. DEPARTMENT OF MOTOR VEHICLES

Diagnostic Vehicle Inspection

MILEAGE

A B

REGISTRATION
TAG NUMBER
MAKE/YEAR
REARVIEW MIRROR
HORN
FLOORING
DEFROST/DEFOG
SEATS
SAFETY LATCH
SEAT BELTS
PADDING
HEAD RESTRAINTS
SUN VISORS
WIPER SYSTEM
WIPER BLADES
WASHER SYSTEM
EMISSION CONTROL
OIL FILLER CAP
ENG LUBRICANT
ENGINE COOLING SYSTEM
HOSES
BELTS
RADIATOR
BATTERY
WIRING & CONNECTORS
POWER STEERING
BELT
HOOD LATCH
SECOND LATCH
MASTER CYLINDER
POWER BOOST HOSE
BRAKE WARN LITE
BRAKE SYSTEM INTEGRITY
TIRE PRESSURE L R
L = LOW H = HIGH F
R
ROLLING RESISTANCE LEVEL
ROLLING RESISTANCE BALANCE
MECH LAG ENGAGE
MECH LAG RELEASE
BRAKE SYSTEM RESPONSE
HYDRAULIC SYSTEM RESPONSE
COMFORT LEVEL IMBALANCE
HIGH LEVEL IMBALANCE
EXCURSION
EXCURSION REVERSAL
OSCILLATION
BRAKE FADE
ANTI SKID DEVICE
EXCESSIVE PEDAL FORCE F
EXCESSIVE PEDAL FORCE R
PEDAL RESERVE
HI
L R
LO
HI BEAM INDICATOR
ENGINE ANALYSIS
IDLE RPM
POINT DWELL
CYL BALANCE
TIMING
IGNITION PRIMARY
IGNITION SECONDARY
CHARGING SYSTEM
SPEEDOMETER
WHEEL SCUFF I O
WHEEL PULLED F
R

CYL STICKING F
CYL STICKING R
CYL LEAKING F
CYL LEAKING R
CYL INOPERAT F
CYL INOPERAT R
BRG SEAL LEAK F
BRG SEAL LEAK R
LINING REVERSE F
LINING REVERSE R
LINING DEFORM F
LINING DEFORM R
LINING THICKN F
LINING THICKN R
UNEVEN WEAR F
UNEVEN WEAR R
LINING CRACK F
LINING CRACK R
LINING LOOSE F
LINING LOOSE R
LINING GLAZED F
LINING GLAZED R
LINING CONTAM F
LINING CONTAM R
LIN UNATTACH F
LIN UNATTACH R
DRUM DIAMETER F
DRUM DIAMETER R
ROTOR THICKN F
ROTOR THICKN R
DRUM DAMAGED F
DRUM DAMAGED R
DRUM CRACKED F
DRUM CRACKED R
LF LR RF RR
A R A R A R A R
AUTO ADJUSTER F
AUTO ADJUSTER R
RETURN SPRING F
RETURN SPRING R
WHEEL CRACKED F
WHEEL CRACKED R
WHEEL LUGS F
WHEEL LUGS R
WHEEL RUNOUT F
WHEEL RUNOUT R
WHEEL BEARING F
WHEEL BEARING R
STEERING LASH
STEERING BINDING
STRG LINK PLAY L
STRG LINK PLAY R
TIE ROD PLAY L
TIE ROD PLAY R
BJ VERTICAL L
BJ VERTICAL R
BJ HORIZONTAL L
BJ HORIZONTAL R

BALL JOINT SEAL L
BALL JOINT SEAL R
SPRING/TORBAR LF
SPRING/TORBAR RF
SPRING/TORBAR LR
SPRING/TORBAR RR
SHACKLE UBOLT LR
SHACKLE UBOLT RR
STRUT/SWAYBUSH LF
STRUT/SWAYBUSH RF
STRUT/SWAYBUSH LR
STRUT/SWAYBUSH RR
SWAY BAR LINKAGE
SHOCK ABSORBER LF
SHOCK ABSORBER RF
SHOCK ABSORBER LR
SHOCK ABSORBER RR
TREAD WEAR LF
TREAD WEAR RF
TREAD WEAR LR
TREAD WEAR RR
TIRE CASING LF
TIRE CASING RF
TIRE CASING LR
TIRE CASING RR
UNDERINFL WEAR
OVERINFL WEAR
TOE WEAR
CAMBER WEAR
UNBALANCE WEAR
TIRE MATCH FRONT
TIRE MATCH REAR
FRONT/REAR MATCH
EXHAUST NOISE
MUFFLER
EXHAUST PIPE
TAIL PIPE
JOINTS
ATTACHMENT
MANIFOLD
HEAT RISER
FRAME L SIDE F
FRAME L SIDE R
FRAME R SIDE F
FRAME R SIDE R
FUEL LINE & CONN
HYD LINE & CONN
WATER LINE & CONN
TRANSMISSION LEAK
CRANKCASE LEAK
DIFFERENTIAL LEAK
GAS TANK LEAK
FUEL PUMP LEAK
OIL FILTER LEAK
WATER PUMP LEAK
FREEZE PLUG LEAK
EA BUMPER LEAK
DRIVE SHAFT LOOSE
MOTOR MOUNT BROKE
EA STRG C COLLAP
STRG C IMP MOUNT
STRG C MT LOOSE
TAIL LAMPS
STOP LAMPS
LICENSE PLATE LAMP
BACKUP LAMPS
SIGNAL LAMP LF
SIGNAL LAMP RF
SIGNAL LAMP LR
SIGNAL LAMP RR
TURN INDICATOR
SIDE MARKER LAMP
HAZARD WARN LAMP
PARKING LAMPS

REFLEX REFLECTOR
LEFT CASTER
RIGHT CASTER
LEFT CAMBER
RIGHT CAMBER
COMPUTED TOE
BRAKE IMBALANCE F
BRAKE IMBALANCE R
FRONT/REAR IMBALANCE
SHOCKS EXCESS F
SHOCKS EXCESS R
PARK BRAKE HOLD
PARK BRAKE LEVER
PARK BRAKE RESERVE
DOOR & HINGES LF
DOOR & HINGES RF
DOOR & HINGES LR
DOOR & HINGES RR
DOOR & HINGES R
LATCH & LOCK LF
LATCH & LOCK RF
LATCH & LOCK LR
LATCH & LOCK RR
LATCH & LOCK R
WINDOW REGULATOR LF
WINDOW REGULATOR RF
WINDOW REGULATOR LR
WINDOW REGULATOR RR
WINDOW REGULATOR R
GAS FILLER CAP
FENDER LF
FENDER RF
FENDER LR
FENDER RR
BUMPER FRONT
BUMPER REAR
WINDSHIELD
DOOR GLASS LF
DOOR GLASS RF
SIDEGLASS LR
SIDEGLASS RR
REAR GLASS
OUTSIDE MIRROR
IGNITION SWITCH
SHIFT INDICATOR

MISC & REMARKS

Consultant ____________
Date ____________

FIGURE 3. TREATMENT GROUP, MANUAL INSPECTION FORM

[redacted]

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3. Headlight Aim - Bear Model 565.

4. Lift - Weaver Twin Post Lift Model EC-102.

5. Emission Analyzer - Stewart-Warner Emission Analyzer 3160-A (Clayton used as backup).

6. Engine Analyzer - Clayton Model CSS-5102.

7. Dynamometer - See brake test equipment.

8. Noise Testing - None.

9. Fuel Economy - None.

10. Other - Record keeping components included:

    - Computer - (AVCO designed software) - Digital Equipment Corporation (DEC) Minicomputer PDP 11/05
    - Storage - Disc Drive DEC-RK05
    - Printer/Keyboard - DEC LA30
    - Cathode Ray Tube (CRT) and Keyboard - DEC UT05
    - Five Computer Interface Pendants - AVCO READIT (proprietary to the system).

11. Equipment Back-up

    - Manual form for recording test data (Figure 3)
    - Roller brake analyzer - on-site emergency repair, platform tester and visual inspection comprised back-up for brake inspection
    - Engine analysis - spare unit was kept on-site and in calibration
    - Headlamp test - spare inspection unit (Bear) kept on site
    - Hydraulic lift - floor jack was used as back-up
    - Dynamic front wheel analyzer - manual camber, caster toe gauges kept on-site as back-up.

12. Mobile Equipment: Mobile vans were ured for office and program participant waiting area. No van equipment was used for testing.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: The schedule of maintenance was as follows:

EQUIPMENT	MAINTENANCE SCHEDULE
. Wheel Alignment	clean and lubricate - weekly
. Scuff Gauge Tester	monthly
. Brake Analyzer	monthly
. Brake System Computer	not defined
. Platform Brake Tester	monthly
. Engine Analyzer	not defined
. Emissions Analyzer	weekly
. Headlight Tester	weekly

2. Frequency of Equipment Calibration: The schedule of calibration was as follows:

EQUIPMENT	CALIBRATION SCHEDULE
. Wheel Alignment - Hunter F-60	weekly
. Scuff Gauge Tester - Weaver WY-27	monthly
. Brake Analyzer - Clayton - DB-8-CP	monthly
. Brake System Computer - Clayton SP-511	monthly
. Platform Brake Tester - WS-75	bi-monthly
. Engine Analyzer - Clayton CSS-5102	not defined
. Emissions Analyzer-Stewart-Warner 3160A	weekly
. Headlight Tester - Bear 565	weekly

VII. FACILITY STAFFING

1. Site Supervisor - one.

2. Lane Supervisor

   - Diagnostic lane - one
   - Control lane - one.

[redacted]

3. Inspectors

   - Diagnostic lane - five
   - Control lane - four.

4. Diagnosticians - Four for the treatment group

5. Quality Control Technician - One.

6. Clerical - Two secretary/clerks.

VIII. TRAINING

1. Supervisor Experience - D.C. Civil Service examination and minimum skill experience of five years of automotive mechanics.

2. Staff Experience - Competitive selection requiring Civil Service examination and requirements. The skill level requirements included a minimum of three years of general automotive mechanical experience. The written examination included basic knowledge and theory of steering, alignment, braking systems, and electrical systems.

3. Quality Control Experience - A mechanical engineer of the Office of Vehicle Safety Research (Department of Motor Vehicles) confirmed quality control compliance monthly. Maintenance and calibration were performed by technicians with an experience level indicated in 2. above.

4. Employee Training Programs

   - 120-160 hours of on-the-job training

   - Manufacturers' courses included:

     - AVCO (three eight-hour days) on computer and peripherals

     - Hunter (40 hours) - wheel alignment at Hunter Engineering

     - Ignition systems- eight hours at the D.C. facility and eight hours at the Clayton Manufacturing Company facility.

     - Hydraulic brake system - four different courses of 8-16 hours (General Motors, Chrysler Corp.,

[redacted]

Ford Motor Co., Volkswagen of America at their East Coast Training Facilities)

- Engine analysis - five eight-hour sessions - Clayton Mfg. at their facility
- Emission control (eight hours) - General Motors at their local training facility
- Steering and suspension - Moog Industries at their facility - classroom instruction and hands-on experience
- Diagnostic inspection procedures - 50 hours given at the Washington, D.C. inspection facility by a consultant (ARTeC).

IX. QUALITY CONTROL*

1. Supervision for Inspectors: A resident lane supervisor monitored the inspection process in the diagnostic lane and the control lane.
2. Criteria for Failure: Qualitative standards prescribed by the D.C. PMVI program and the manufacturer's specifications were used.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Reinspection following a failed inspection was made on an unscheduled basis within ten days of the issuance of a rejection sticker. Reinspection by the motorists request for observation of a deteriorating condition was made by appointment only.

XI. CUSTOMER INTERFACE

1. Counseling: The participant was provided with a printout of the condition of his vehicle subsystems. The counselor advised on potential remedies for failures. No prescriptive information, potential cost of repair, or recommendations were given as to repair facilities.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: 25-30 minutes
2. Time at Each Station in the Lane:

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* In addition to the measures cited in this section, all projects were monitored through on-site visits and reviews of procedures and documentation by a Technical Support contractor reporting to NHTSA. Visits were monthly until September 1975, then reduced to quarterly.

- Station 1 - 14.6 minutes
- Station 2 - 6.3 minutes
- Station 3 - 3.1 minutes
- Station 4 - 1.5 minutes
- Counseling - 3.4 minutes.

3. Average Diagnostic Lane Throughput - 30/day.

4. Appointments Used - Yes.

XIII. CONSUMER AND COMMUNITY RELATIONS

Information releases were made to various media to present the inspection program to the general public. The emphasis of these media releases was to inform the public about using the diagnostic inspection service.

XIV. INVESTMENT AND OPERATING COSTS

1. Facility CSC estimate - Efficiency of Design Report

   - Structure - $270,000 (Estimated 1976 replacement cost)
   - Land (including land acquisition, site prep, drive surface, etc.) - $463,250. (Estimated 1976 replacement cost)

2. Equipment

   - Major inspection equipment - $77,142
   - Other equipment - $8,505 (impact wrench, drum gauge, micrometers, hose reels, hand tools, etc.)
   - Support equipment - $28,230 (Typewriter, camera, optical reader, movie projector, etc.)
   - Computer system - $160,000.
   - Computerized Brake Analyzer - $42,000 (estimate)

3. Operating Labor Cost:

   - Diagnostic (Treatment) Inspection - $242,000/year
     - Lane supervisor - $8.80/hour
     - Five inspection technicians - $5.50 to $7.70/hour
     - Three consultants - $5.50 to $7.70/hour
   - Control Inspection - $29,000/year
     - Lane supervisor - $8.80/hour
     - Four inspectors - $5.50 to $7.70/hour

- Supervisor and Administrator Cost - $4,867/month
    - Site supervisor - $11.70/hour
    - Two secretary/clerks - $4.15/hour.
- Maintenance and Quality Control - $1,199/month
    - Quality control technician - $6.97/hour.

[redacted]

DIAGNOSTIC DEMONSTRATION PROJECT
CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: Puerto Rico Motor Vehicle
Diagnostic Inspection
Demonstration Project
Isla Grande, San Juan, P.R.

2. Contact Name and Number: Information no longer available.

3. General Description of Facility: A vehicle diagnostic inspection demonstration, sponsored by NHTSA, was conducted by Puerto Rico's Department of Transportation and Public Works at three similarly constructed and instrumented facilities. The vehicle diagnostic inspection was conducted at the Isla Grande site from May 1975 to the end of June 1976. The demonstration was conducted with two volunteer groups: a treatment group that received inspection on 178 individual components and included an engine analysis; and a control group that received inspection on the same subsystems but fewer components (88), less stringent inspection on brakes, and no engine analysis. In order to retain the participants, both groups received the same level of counseling.

   The facility housed two inspection lanes, a bay area for special inspections, a participant waiting room with a partitioned counseling area, a storage area, and a site supervisor's office.

4. Vehicle Types Inspected: The volunteers for the demonstration were drawn from passenger cars of the 1968-1973 make/model sets specified by NHTSA. The vehicles included all major manufacturers of the United States (American Motors, Chrysler, Ford, General Motors) and popular imports (Datsun, Toyota, Volkswagen).

5. Types of Inspection Service: The inspections representative of the facility's capability were those given to the treatment group. The inspection provided to this group included:

   - Brakes - dynamic brake test using a dynamometer, wheel pull to examine one front and one rear wheel brake lining material and components

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* Also sponsored by the Commonwealth of Puerto Rico, which contributed at least 10% matching funds, per the Act, though it did not have to be directly in cash.

[redacted]

- Exhaust emission - unloaded emissions test at 2250 RPM and engine idle speed
- Engine analysis - cylinder balance, charging voltage and pattern, ignition primary and secondary patterns
- Wheel alignment - automated instrument dynamic reading of caster, camber and toe angles
- Steering/suspension - visual inspection of shock absorbers, energy absorbing steering column, springs, ball joints, tie rods, wheel play
- Drive train - visual inspection of transmission, differential and drive shaft
- Lights - headlight aim inspection by instrument, visual inspection of brake lights, directional lights, stop lights, rear lights, side marker lights
- Tires and wheels - visual inspection of condition of wheels and tires, wheel balance
- Interior - visual inspection of seats, head restraints, rear view mirror, horn, windshield wipers and washer, speedometer, transmission shift lever and indicator
- Body/chassis - visual inspection of frame, bumpers, doors, hood, fenders, glazing, outside mirror, latches and locks, gas filler cap
- Reinspection of all failed components.

6. Hours of Operation: 8:00 a.m.-5:00 p.m. (closed between 12:00-1:00 p.m.) - Monday through Saturdays.

7. Physical Area of Inspection Facility: The 8,640-square-foot inspection facility housed two lanes for diagnostic inspection, a bay area for incentive repair, a participant waiting room, storage space and an office. The lanes occupied approximately two-thirds of this area.

8. Inspection Station Dimensions: The inspection facility dimensions included:

    - Lane inspection area - approximately 40' wide x 144' long
    - Bay (for incentive repairs) - approximately 15' wide x 20' long
    - Waiting room - approximately 15' wide x 23' long.

9. Number of Lanes/Bays:

    - Two lanes
    - One bay for incentive repairs.

10. Lane/Bay Dimensions:

    - Each lane was approximately 18' wide x 144' long. A safety lane between the inspection lanes permitted the participant to walk and observe the testing process.
    - A bay used for a free wheel alignment repair as an incentive to participate in the program was approximately 15' wide x 20' long.

11. Queueing Area: A parking area was provided for the motorist near the reception area for queueing into the inspection lanes. The motorist logged in, received directions on when and which lane to use. He then drove to this lane and was met by the assigned inspector.

12. Parking Area: Information not available.

13. Facility Diagram and Location of Equipment: See Figure 1.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: November 1974 - May 1975.

2. Construction Type and Material: Each of the three facilities of the Puerto Rico demonstration was constructed identically. Each was constructed of prefinished sheet metal and masonry placed on a concrete slab.

[redacted]

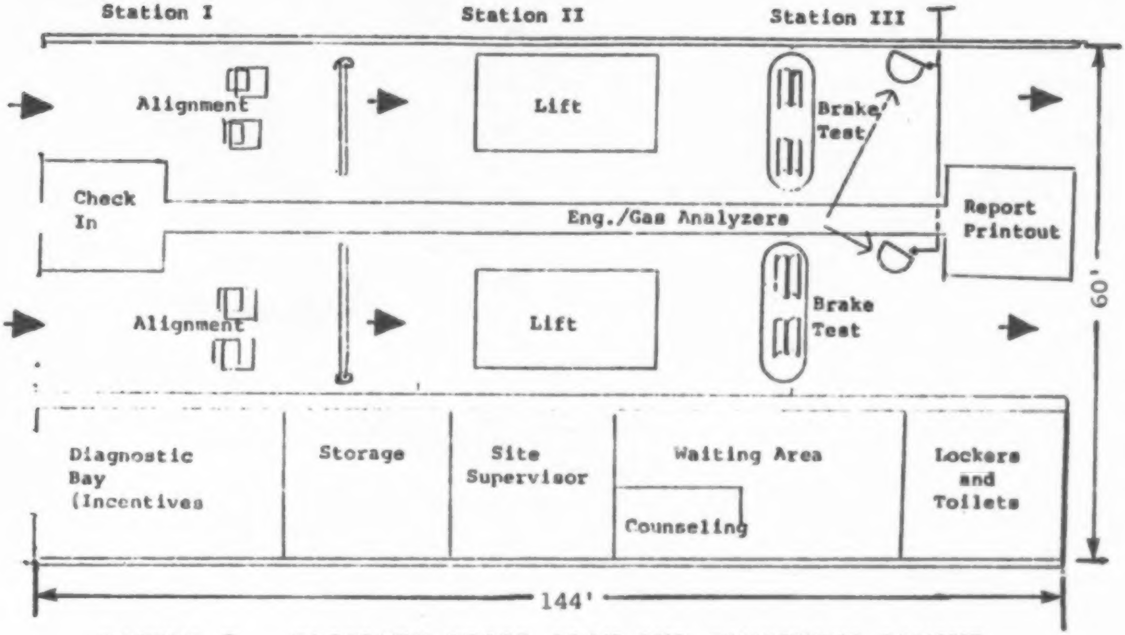

Station I
Station II
Station III
Alignment
Lift
Brake Test
Check In
Eng./Gas Analyzers
Report Printout
Alignment
Lift
Brake Test
60'
Diagnostic Bay (Incentives
Storage
Site Supervisor
Waiting Area
Counseling
Lockers and Toilets
144'

FIGURE 1. FACILITY FLOOR PLAN AND EQUIPMENT LAYOUT

3. Patron Accommodations: A 345-square-feet (15' x 23') waiting room was made available to the patrons. Captioned photographs of the inspection lanes were placed on the walls to inform the patrons. Toilet facilities and a drinking fountain were made available. Large windows overlooking the inspection lanes permitted the vehicle owner to observe the process of inspection. A sidewalk with guard rail paralleling the inspection lanes was available to vehicle owners who wished to accompany their vehicle through the inspection process.

4. Ventilation System Design: The facility had louvered openings along the side wall and supplemental exhaust fans to ventilate the inspection lanes.

5. Safety Accommodations: Normal safety procedures were observed.

6. Noise Accommodations: None.

BEST DOCUMENT AVAILABLE

III. STEPS OF INSPECTION PROCESS

1. Check-In: Upon arriving at the inspection facility, the participant reported to a receptionist. The motorist provided the receptionist the embossed plastic identification card (name, address, telephone number, vehicle identification number, registration number, make, model, year, vehicle mileage at time of first inspection, date of first inspection, group designation) given to him at his first inspection. The receptionist imprinted the card information on a mark sense data sheet and gave this sheet to an inspector as he became available. The motorist was asked to take the vehicle to the appropriate lane where the inspector took over.

2. Test Sequence:

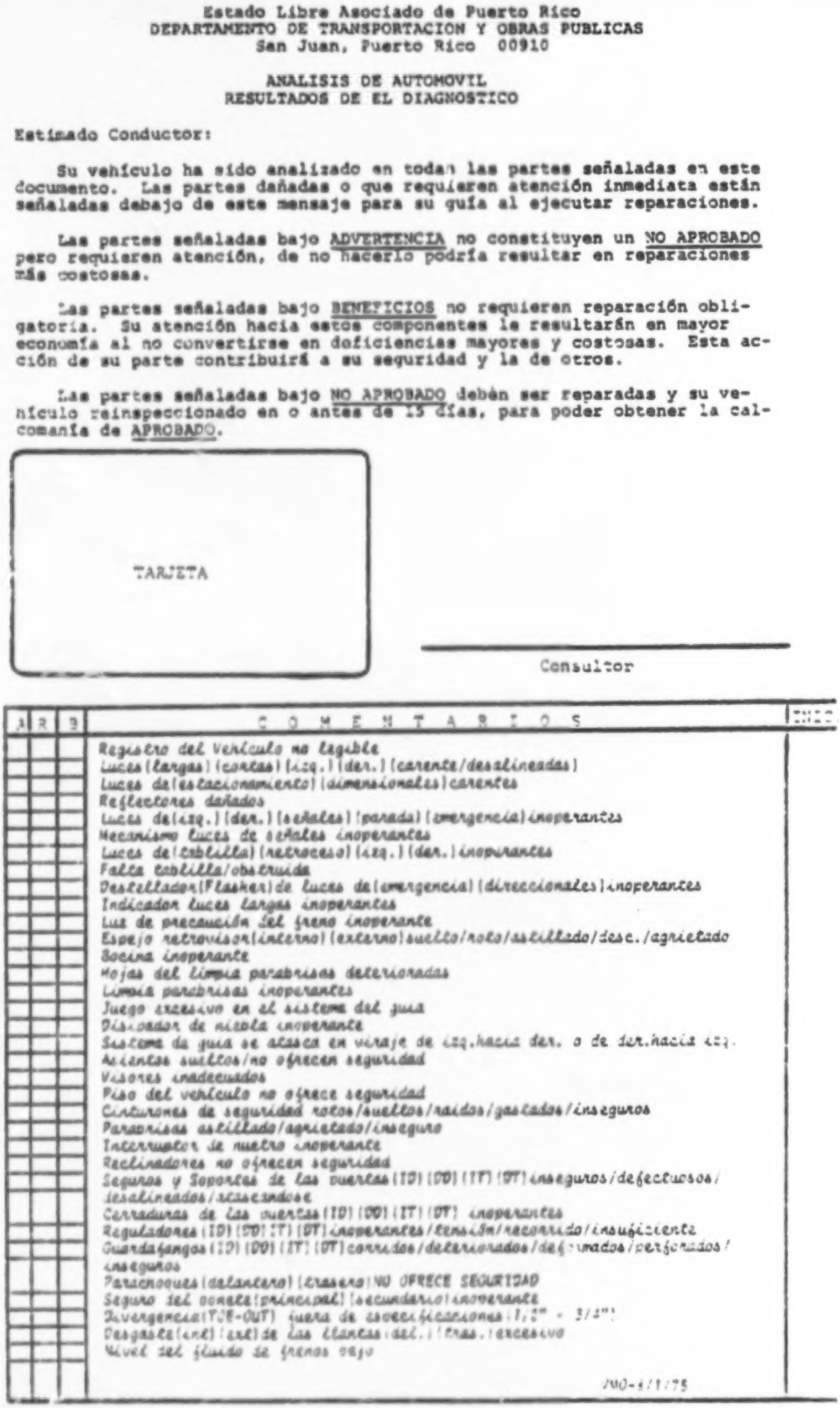
   - Station 1 - Tire condition and pressure (inflate if necessary); headlamps; exterior lighting; steering wheel lash; interior and exterior condition of vehicle; front end alignment; underhood; interior lighting; brake system integrity.

   - Station 2 - Vehicle underbody; exhaust system; tire wear; wheel run-out and general condition; wheel balance; wheel pull to determine condition of linings, drums, etc.; steering components; suspension components (ball joints, springs, shocks, etc.); fuel system.

   - Station 3 - Dynamic brake testing, brake pedal reserve; emissions inspection (unloaded); treatment group only: engine analysis.

3. Data Handling: Automated. The inspector marked the results of the inspection on a mark sense form. At the end of the inspection the form was given to a data processor who processed the form through a mark sense reader and printed out a report form for the counselor and the participant. Figures 2 and 3 show the forms provided to the treatment and control groups.

4. Check-Out: The motorist received a computer printout of the rejected vehicle subsystems (the treatment group received additional information which identified the defective components which appeared marginal). The counselor discussed the findings of the inspection with both groups.



Estado Libre Asociado de Puerto Rico
DEPARTAMENTO DE TRANSPORTACION Y OBRAS PUBLICAS
San Juan, Puerto Rico 00910

ANALISIS DE AUTOMOVIL
RESULTADOS DE EL DIAGNOSTICO

Estimado Conductor:

Su vehículo ha sido analizado en todas las partes señaladas en este documento. Las partes dañadas o que requieren atención inmediata están señaladas debajo de este mensaje para su guía al ejecutar reparaciones.

Las partes señaladas bajo ADVERTENCIA no constituyen un NO APROBADO pero requieren atención, de no hacerlo podría resultar en reparaciones más costosas.

Las partes señaladas bajo BENEFICIOS no requieren reparación obligatoria. Su atención hacia estos componentes le resultarán en mayor economía al no convertirse en deficiencias mayores y costosas. Esta acción de su parte contribuirá a su seguridad y la de otros.

Las partes señaladas bajo NO APROBADO debén ser reparadas y su vehículo reinspeccionado en o antes de 15 días, para poder obtener la calcomanía de APROBADO.

TARJETA

Consultor

A	R	B	COMENTARIOS	INIC
			Registro del Vehículo no legible	
			Luces(largas)(cortas)(izq.)(der.)(carente/desalineadas)	
			Luces de(estacionamiento)(dimensionales)carentes	
			Reflectores dañados	
			Luces de(izq.)(der.)(señales)(parada)(emergencia)inoperantes	
			Mecanismo luces de señales inoperantes	
			Luces de(tablilla)(retroceso)(izq.)(der.)inoperantes	
			Falta tablilla/obstruida	
			Destellador(Flasher)de luces de(emergencia)(direccionales)inoperantes	
			Indicador luces largas inoperantes	
			Luz de precaución del freno inoperante	
			Espejo retrovisor(interno)(externo)suelto/roto/astillado/desc./agrietado	
			Bocina inoperante	
			Hojas del limpia parabrisas deterioradas	
			Limpia parabrisas inoperantes	
			Juego excesivo en el sistema del guía	
			Disipador de niebla inoperante	
			Sistema de guía se atasca en viraje de izq.hacia der. o de der.hacia izq.	
			Asientos sueltos/no ofrecen seguridad	
			Visores inadecuados	
			Piso del vehículo no ofrece seguridad	
			Cinturones de seguridad rotos/sueltos/raídos/gastados/inseguros	
			Parabrisas astillado/agrietado/inseguro	
			Interruptor de neutro inoperante	
			Reclinadores no ofrecen seguridad	
			Seguros y Soportes de las puertas(ID)(DD)(IT)(DT)inseguros/defectuosos/desalineados/atascándose	
			Cerraduras de las puertas(ID)(DD)(IT)(DT) inoperantes	
			Reguladores(ID)(DD)(IT)(DT)inoperantes/tensión/recorrido/insuficiente	
			Guardafangos(ID)(DD)(IT)(DT)corroídos/deteriorados/deformados/perforados/inseguros	
			Parachoques(delantero)(trasero)NO OFRECE SEGURIDAD	
			Seguro del bonete(principal)(secundario)inoperante	
			Divergencia(TOE-OUT) fuera de especificaciones(1/8" - 3/8")	
			Desgaste(int)(ext)de las llantas(del.)(tras.)excesivo	
			Nivel del flúido de frenos bajo	

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FIGURE 2. INSPECTION RESULTS FORM PROVIDED TO TREATMENT GROUP

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A	R	B	C O M E N T A R I O S	INIC.
			Bateria(deteriorada/agrietada/corroida/polos rotos/sueltos/conección suelta	
			Unidad de potencia del guia(Power Steering)dañada/filtrando/correas;poleas (del acondicionador de aire)(del alternador)(de la unidad de potencia del guia)(de la bomba del agua)(del abanico)raldas/gastadas/tensión inadecuada	
			Fluido de la unidad de potencia(Power Steering) del guia bajo	
			Mangueras de la unidad de potencia de guia(No ofrecen seguridad/raldas/gastadas/filtrando	
			Filtración de vacio en la unidad de potencia de frenos	
			Filtración de aceite de motor parte(superior)(inferior)	
			Conjunto del sistema de frenos(Brake System)	
			Unidad de potencia(Power Brake) del freno no funciona	
			Conducto de vacio de la unidad de potencia del freno(doblado)	
			Amortiguadores de golpe(Shock Absorbers)(ID)(DD)(IT)(DT)inestables/filtrando	
			Junta esferica(Ball Joints)(IS)(DS)(II)(DI)juego excesivo	
			Sello de la junta esferica(Ball Joints)(IS)(DS)(II)(DI)dañado(s)	
			Aros(ID)(DD)(IT)(DT)doblados/agrietados	
			Tornillos y tuercas(ID)(DD)(IT)(DT)rotos/faltan	
			Gomas(ID-10+32)(DD-8:10/32)(IT-6:8/32)(DT-4:8/32)desgaste excesivo	
			Gomas(ID)(DD)(IT)(DT)desbalanceadas	
			Comb. de gomas(traseras/delanteras)inseguras/dif.mfg./dif.tamaño/radiales en un solo eje	
			Paredes de las gomas(ID)(DD)(IT)(DT)inseguras	
			Valvulas de las gomas(Valve Stems)(ID)(DD)(IT)(DT)inseguras	
			Conducto fluido de frenos(ID)(DD)(IT)(DT) filtrando/achatado	
			Manguera fluido de frenos(ID)(DD)(IT)(DT) filtrando/achatado/doblada	
			Cilindros de frenos(ID)(DD)(IT)(DT) filtrando/atascandose/rozando	
			Comp. del freno(ID)(DD)(IT)(DT) mal instalados	
			Zapatas de los frenos(ID)(DD)(IT)(DT)invertidos	
			Bandas de freno(ID)(DD)(IT)(DT)desprendidas/contaminadas/cristalizadas	
			Bandas(ID)(DD)(IT)(DT)(0:/32,1:2/32,2 3/32,3/32,4+/32)gastadas	
			Tambor/Rotor(ID)(DD)(IT)(DT)agrietado/rayado/gastado	
			Ajuste automatico(ID)(DD)(IT)(DT)inoperante/falta	
			Resorte retractor de frenos(ID)(DD)(IT)(DT)inestable/tensión/(inadecuada)	
			Articulación del guia(Steering Linkage)suelto/gastado	
			Pedal de freno/de emergencia no retroceden	
			Freno de emergencia inoperante	
			La Zeta(Idler Arm)lubricación insuficiente/gastada/suelta	
			Barra de conección(Pitman Arm)lubricación insuficiente/gastada/suelta	
			Terminales(Ext.Izq.)(Ext.Der.)(Int.Izq.)(Int.Der.)lubricación insuficiente/gastada/suelta	
			Barra de Machon(Strut Rod)suelta/doblada/partida/(Izq.)(Der.)	
			Brazo de Control(Control Arm)(Izq.Sup.)(Der.Sup.)(Izq.Inf.)(Der.Inf.)roto/suelto/agrietado/deformado/lub. insuficiente	
			Casquillos(Bushings)(Izq.)(Der.)lubricación insuficiente/suelto	
			Barra de ladeo(Sway Bar)suelta/dañada/(Izq.)(Der.)(trasera,delantera)	
			Cojinetes de bolas de las ruedas, delanteras,(Izq.)(Der.)decoloridas/filtración de grasa/aceite/lub. insuficiente/rayada	
			Sistema de escape inadecuado	
			Silenciador/resonador/corroido/deteriorado/filtrando	
			Tubo de escape(corroido/deteriorado/filtrando)	
			Tubo multiple(roto/suelto/agrietado)	
			Uniones universales(lub.insuficiente/faltan tornillos/tuercas gastadas/suelta	
			Juntas del sistema de escape(filtrando)	
			Cola(corroida/deteriorada/filtrando)	
			Filtración del diferencial	
			Resortes/barras de torsión(ID)(DD)(IT)(DT)inseguras	
			Grillete de Resorte(Shackle)(trasero)(delantero)(Izq.)(Der.)suelto/dañado	
			Tirante de radio(Radius Rod)(Izq./Der.)suelto/dañado	
			Bomba/conducto del combustible/filtrando	
			Tanque de gasolina filtrando	
			Alta resistencia de rodaje(ID)(DD)(IT)(DT)	
			Frenos delanteros/traseros(Izq.30:50%)(Der.74+%)	
			Balance de frenos delanteros/traseros inseguros(50:60%)	
			Recorrido excesivo de frenos antes de accionarse(0:10%)	
			Emisión(HC-0:100PPM)Hidrocarburo alto en su nivel en(baja)mayor revolución	
			Emisión(CO-1:2%/3:5%)Monoxido de carbono alto en su nivel en(baja)mayor revolución	
			Escape de humo excesivo	
			Goma(sobre inflada)(desinflada)	
			Luz de precaución del motor inoperante	
			Material de protección(Pad)interior inadecuado	
			Sistema de precaución de cinturones inoperantes	
			Inclinación de rueda(Caster)(Izq.-0")(Der.-0:1/2")fuera de las especificaciones	
			Inclinación del eje(Camber)(Izq.+1:2")(Der.-2:3")fuera de las especificaciones	

FIGURE 2. (Continued)

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A	R	8	COMENTARIOS	INIC.
			Alambres de la ignición(quemado/conto circuito/falta conección/roto/suelto	
			Alambres electricos no ofrecen seguridad	
			Nivel del fluido de(la trasmisión)(motor)bajo	
			Radiador dañado/filtrando	
			Abrazadera de la bateria(Hold Down)inadecuada	
			Bomba de agua filtrando/gastada/suelta	
			Mangueras del(calefactor/enfriador/(coolant)raldas/gastadas/filtrando	
			Puntos del motor no ofrecen seguridad	
			Sellos de motor filtrando	
			Acoplamiento de frenos(ID)(DD)(IT)(DT)lento	
			Fuerza de frenaje(ID)(DD)(IT)(DT) bajo en paradas lentas	
			Frenos tienen(ID)(DD)(IT)(DT)tienen restricción electrica	
			Fuerza de frenaje(ID)(DD)(IT)(DT)inestable	
			Angulo de retardación(DWELL ANGLE)alto/bajo	
			Revoluciones (R.P.M.)alto/bajo	
			Circuito(secundario/primario)necesita atención	
			Energia desigual en los cilindros del motor	
			Distribuidor gastado	
			Alternador necesita atención	
			Voltaje de carga de la bateria incorrecto(alto/bajo)	
			Voltaje de arranque incorrecto(Cranking Voltage)	
			NOTA: Favor de someter las facturas comprobantes cuando retorne su vehículo para ser reinspeccionado.	

FIGURE 2. (Continued)

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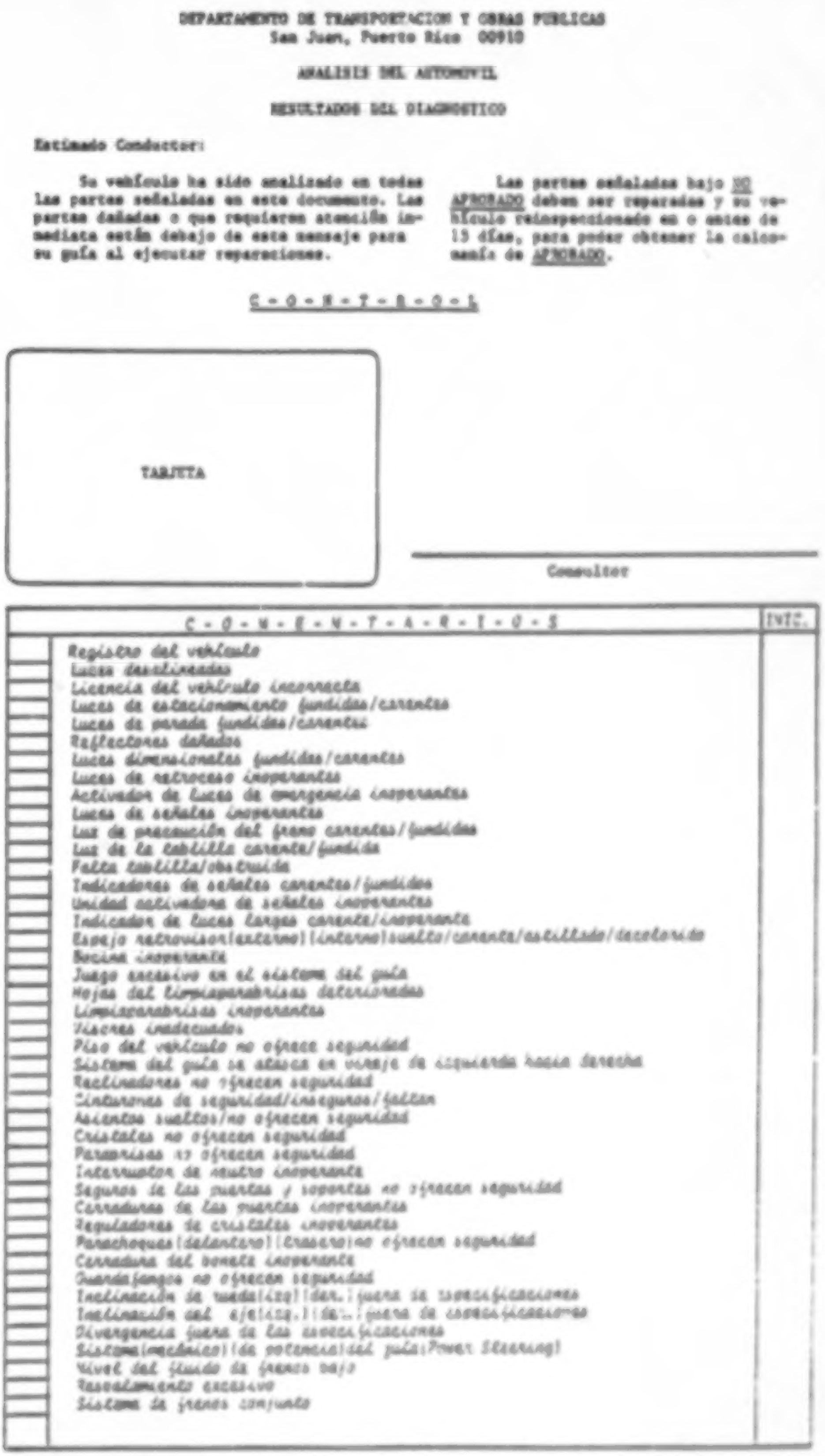

DEPARTAMENTO DE TRANSPORTACION Y OBRAS PUBLICAS
San Juan, Puerto Rico 00910

ANALISIS DEL AUTOMOVIL

RESULTADOS DEL DIAGNOSTICO

Estimado Conductor:

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Las partes señaladas bajo NO APROBADO deben ser reparadas y su vehículo reinspeccionado en o antes de 15 días, para poder obtener la calcomanía de APROBADO.

CONTROL

TARJETA

Consultor

	COMENTARIOS	INIC.
☐	*Registro del vehículo*	
☐	*Luces desalineadas*	
☐	*Licencia del vehículo incorrecta*	
☐	*Luces de estacionamiento fundidas/carentes*	
☐	*Luces de parada fundidas/carentes*	
☐	*Reflectores dañados*	
☐	*Luces dimensionales fundidas/carentes*	
☐	*Luces de retroceso inoperantes*	
☐	*Activador de luces de emergencia inoperantes*	
☐	*Luces de señales inoperantes*	
☐	*Luz de precaución del freno carentes/fundidas*	
☐	*Luz de la tablilla carente/fundida*	
☐	*Falta tablilla/obstruida*	
☐	*Indicadores de señales carentes/fundidos*	
☐	*Unidad activadora de señales inoperantes*	
☐	*Indicador de luces largas carente/inoperante*	
☐	*Espejo retrovisor(externo)(interno)suelto/carente/astillado/decolorido*	
☐	*Bocina inoperante*	
☐	*Juego excesivo en el sistema del guía*	
☐	*Hojas del limpiaparabrisas deterioradas*	
☐	*Limpiaparabrisas inoperantes*	
☐	*Viseras inadecuadas*	
☐	*Piso del vehículo no ofrece seguridad*	
☐	*Sistema del guía se atasca en viraje de izquierda hacia derecha*	
☐	*Reclinadores no ofrecen seguridad*	
☐	*Cinturones de seguridad/inseguros/faltan*	
☐	*Asientos sueltos/no ofrecen seguridad*	
☐	*Cristales no ofrecen seguridad*	
☐	*Parabrisas no ofrecen seguridad*	
☐	*Interruptor de neutro inoperante*	
☐	*Seguros de las puertas y soportes no ofrecen seguridad*	
☐	*Cerraduras de las puertas inoperantes*	
☐	*Reguladores de cristales inoperantes*	
☐	*Parachoques(delantero)(trasero)no ofrecen seguridad*	
☐	*Cerradura del bonete inoperante*	
☐	*Guardafangos no ofrecen seguridad*	
☐	*Inclinación de rueda(izq)(der.)fuera de especificaciones*	
☐	*Inclinación del eje(izq.)(der.)fuera de especificaciones*	
☐	*Divergencia fuera de las especificaciones*	
☐	*Sistema(mecánico)(de potencia)del guía(Power Steering)*	
☐	*Nivel del fluido de frenos bajo*	
☐	*Resbalamiento excesivo*	
☐	*Sistema de frenos conjunto*	
☐		

FIGURE 3. INSPECTION RESULTS FORM PROVIDED TO CONTROL GROUP

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	COMENTARIOS	INIC.
☐	Sistema de frenos de Potencia(Power Brake)	
☐	Puntos del motor partidos	
☐	Aros dañados	
☐	Junta esférica no ofrece seguridad(Ball Joints)	
☐	Amortiguadores inseguros(Shock Absorbers)	
☐	Tornillos y tuercas/rotos/faltan	
☐	Goma izq.(delantera)(trasera)con desgaste excesivo	
☐	Goma der.(delantera)(trasera)con desgaste excesivo	
☐	Gomas desbalanceadas	
☐	Válvulas de la goma inseguras	
☐	Paredes de las gomas inseguras	
☐	Combinación de gomas(delanteras)(traseras)inseguras	
☐	Conducto del sistema de frenos inseguro	
☐	Conducto de fluido de frenos obstruido	
☐	Bandas izquierdas(delanteras)(traseras)gastadas	
☐	Articulación del guía inseguro	
☐	Freno de emergencia inoperante	
☐	Eje caldan inseguro	
☐	Sistema de escape inadecuado	
☐	Cojinete de bolas inseguro	
☐	Sistema de alimentación de gasolina inseguro	
☐	Suspensión insegua	
☐	Barra de torsión/resortes inseguros	
☐	Sistema de freno inseguro	
☐	Desbalance de frenos(delanteros)(Traseros)	
☐	Desbalance de frenos(traseros)delanteros)combinados	
☐	Recorrido excesivo antes de accionarse los frenos	
☐	Emisión(HC)Hidrocarburo alto en el nivel(en baja)(a mayor revolución)	
☐	Emisión(CO)Monoxido de Carbono alto en su nivel(en baja)(a mayor revolución)	
☐	Escape de humo excesivo	
	NOTA: Favor de someter las facturas comprobantes cuando retorne su vehículo para ser reinspeccionado.	

FIGURE 3. (Continued)

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IV. FEES

1. Diagnostic Inspection: The diagnostic inspection was free to the participants of this program. The participants, in turn, were expected to have necessary repairs performed, return for reinspection (with repair invoices) and record fuel consumption.

2. Other Services: The Puerto Rico project management considered providing small repair services as an incentive to motorists to stay in the program. Services which were considered included carburetor adjustment, brake adjustment, wheel balance, headlamp aim, replenishment of fluids (battery, brake, windshield washer, power steering), replacement of exterior light bulbs if a single unit (except headlights) was burned out. With the exception of wheel balancing, these services were to be provided in the lanes during the inspection process. The extent to which these services were provided has not been documented.

V. TEST EQUIPMENT

1. Brakes: Each lane had a Clayton DB-8-CP dynamic brake analyzer.

2. Alignment: Each lane had a Hunter F-60 dynamic wheel aligner to measure camber, caster and toe angles

3. Headlight Aim: Each lane had Bear Model 561 headlight aim instrument. The bay had a Hopkins Headlamp Aimer Model 540.

4. Lift: Each lane had a Lincoln Model 7112 four-post lift and a portable lift. The Western Model Ranger 2 was available in the bay.

5. Emission Analyzer: Each lane had an Allen 18-200 Engine Analyzer which contained an infra-red exhaust emission analyzer.

6. Engine Analyzer: See emission analyzer.

7. Dynamometer: Brake dynamometer only (DB-8-CP). See Brakes.

8. Noise Testing: None.

9. Fuel Economy: None.

10. Other: Each lane had a Lincoln Model 84016 Wheel spinner. The bay had a Hunter Electronic Wheel Balancer Model 25421 and Hunter Balancer Indicator.

11. Back-up: The redundancy in equipment permitted back-up of down equipment.

12. Library: Information not available.

13. Mobile Equipment: To expedite training prior to the opening of any of the Puerto Rico facilities, a mobile inspection van owned by NHTSA was made available to the project. The van included an electric lift, a dynamic brake analyzer, a headlight aimer, an engine/gas analyzer, a toe gauge and an interior crane to facilitate movement and storage of the equipment. This equipment was used on vehicles of volunteer owners for training purposes. Once the three facilities in Puerto Rico were operational the van was no longer used.

VI. EQUIPMENT

1. Frequency of Equipment Maintenance:

Equipment	Maintenance Schedule
. Wheel Alignment Tester	a) clean-daily b) lubricate-weekly
. Wheel Spinner	a) spinner and strobe-as required b) pickup unit quarterly
. Brake Analyzer	a) quarterly
. Engine and Emissions Analyzer	a) as required
. Headlamp Tester	a) clean-daily b) lubricate-weekly

2. Frequency of Equipment Calibration:

Quality Control - Calibration/maintenance data sheets were recorded and filed each time equipment was calibrated and repaired. Station supervisors were required to submit problem reports when they knew, or suspected, malfunctions in the equipment. The reports were given to the maintenance and calibration crew.

Equipment	Calibration Schedule
. Wheel Alignment Tester - Hunter F-60	a) quick check-weekly b) calibration-monthly

Wheel Spinner - Hunter 25-42-1	a) strobe cal-monthly
Brake Analyzer-Clayton DB-8-CP	a) partial cal-monthly b) Full cal-after hydraulic system refill
Engine Analyzer and Infra-Red Exhaust Emission Analyzer-Allen 18-200	a) emissions cal-daily b) engine cal-monthly
Headlamp Tester-Bear 561	a) floor level cal-weekly b) side aim cal-monthly

VII. FACILITY STAFFING

Excluding project and administrative support, the staff complement included:

- Site supervisor
- Two receptionists/clerks
- Thirteen technicians
- One counselor
- One computer operator.

VIII. TRAINING

1. Staff Experience:

- Supervisor experience - experience as senior mechanic with Pan American Airlines
- Inspector experience - graduates of the Vocational Training Center of the University of Puerto Rico or former mechanics of Pan American Airlines.

2. Employee Training:

- Calibration technician - 120 hours classroom training.
- Site supervisor - 60 hours classroom training.

- Inspectors/technicians - initially 80 hours (23 technicians of the three facilities) reduced to 60 hours (20 technicians); mechanics who joined from Pan American with mechanic experience (6) received 40 hours of training.
- Computer operator - 24 hours classroom training and on-the-job training.
- Secretary/receptionist/file clerk - 24 hours.

IX. QUALITY CONTROL*

1. Supervision of Inspectors: Each lane had a lead inspector who supervised and arbitrated any problems that arose.
2. Surveys of Customer Satisfaction: No surveys were conducted. Letters of support for the program were received.
3. Criteria for Failure: Existing local standards, Federal VIU standards, and manufacturers' tolerances were used. A printed manual of these criteria was given to each inspector and the limits of "advise" or "reject" were specified.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

The participants had to follow the Puerto Rico PMVI statutes of returning for reinspection of rejected inspections within 15 days. The participants were required to bring the repair bill with them. These bills were photostatted and sent to the project office for analysis. While it was initially intended that reinspections would be conducted in the bay area, in practice, most reinspections were performed in the inspection lanes.

XI. CUSTOMER INTERFACE

1. Counseling: An area of approximately 88 square feet was partitioned and set aside in the waiting room for use by the counselor when talking to vehicle owners during the post-inspection briefing. The counselors discussed the meaning of the computer printout items which were listed as "advise" or "reject" with the treatment group participants. In contrast, the control group participants were told that a subsystem was "rejected". A debriefing was also given after reinspection. The

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* In addition to the measures cited in this section, all projects were monitored through on-site visits and reviews of procedures and documentation by a Technical Support contractor reporting to NHTSA. Visits were monthly until September 1975, then reduced to quarterly.

counselor reviewed the repair costs and subsystems repaired to determine if the repairs made were those identified in the inspection. If additional work was performed, the counselor would attempt to identify the reason.

XII. STATION VEHICLE PROCESSING TIME

1. Processing Time per Vehicle: The full inspection process for the treatment group approximated twenty minutes for inspection and three to five minutes for counseling.

2. Time at Each Station in the Lane:

   - Station 1 - 6 minutes
   - Station 2 - 8 minutes
   - Station 3 - 6 minutes.

3. Theoretical Maximum Lane Throughput: 57 vehicles/lane/day.

4. Average Lane Throughput (Expected): 40 vehicles/lane/day.

5. Appointments Used: Yes.

XIII. CONSUMER AND COMMUNITY RELATIONS

Presentations were made to community personnel and agencies to acquaint them with the project and to solicit their support to obtain volunteers for the program. Police cooperation was sought and obtained. Police cars were provided with taped messages which they used over their public address systems. Repair industry personnel were invited to seminars to brief them on the project objectives and methodology. The presentations given included:

Audience	Number of Presentations	Hours of Presentations
1. Repair Industry	25	52
2. Government Agencies	51	109
3. Civic Clubs	40	83
4. Police Department	12	29
5. Station Inspection Facility Owners	29	63

[redacted]

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment:

   - Facility
     - Structure: $173,820
     - Land and improvements: $225,330
   - Equipment

- Major inspection equipment in two lanes	$72,078
- Miscellaneous equipment (ball joint checker, runout gauge, pneumatic jack, hand tools, etc.)	5,276
- Support equipment (minicomputer, photocopier, addressograph, keyboard/printer, air compressor, etc.)	25,920
- Inspection equipment in bay	7,980
	$111,254

2. Operating Labor Costs: $6,938/month

   - Labor Rate
     - Inspectors: $3.24/hour
     - Counselors: $4.05/hour
     - Maintenance/calibration: $4.05/hour.

3. Supervisory and Administrative Costs: $1,722/month

   - Site supervisor: $5.25/hour
   - Staff secretary: $2.50/hour
   - Records clerk: $2.50/hour.

DIAGNOSTIC DEMONSTRATION PROJECT CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. **Facility Name and Adress:** Project Auto/SEE
Tennessee Motor Vehicle Diagnostic Inspection Demonstration Project
3204 Annicola Highway
Chattanooga, Tennessee 37406

2. **Contact Name and Number:** Information no longer available.

3. **General Description of Facility:** A vehicle diagnostic inspection demonstration, sponsored by NHTSA, was conducted by the University of Tennessee with the support of the City of Chattanooga. The demonstration project conducted vehicle diagnostic inspection from February 1975 through June 1976. Until October 1975 these inspections were conducted in a temporary facility, and were then transferred into a permanent facility which was shared with the PMVI program conducted by the City.

The demonstration program was conducted with two volunteer groups chosen from the City's motorists. Participation in Auto/SEE excused the motorists from the City's mandatory inspection process. The two groups were a treatment and a control group. The treatment group received a more thorough examination:

- **Brakes** - the treatment group received a dynamic brake test and wheel pull inspection, while the control group brake test was limited to a brake equalization test on a platform brake tester.
- **Front end alignment** - the treatment group had caster, camber and toe measurements taken while the control group inspection consisted of side slip measurement using a scuff gauge.
- **Engine analysis and emissions** - the treatment group inspection consisted of an engine analysis and a loaded mode emissions test, while the control group inspection consisted of an idle mode emissions test.

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* Also sponsored by the State of Tennessee; each State contributed at least 10% matching funds, per the Act, though it did not have to be directly in cash.

- Visual inspections of subsystem components were more thorough for the treatment than for the control group.

The demonstration project conducted the major diagnostic inspections in a lane configuration designed for relatively high throughput. The Auto/SEE project used two lanes of the four existing in the facility. (The other two lanes were used for the Chattanooga PMVI program). All of the Auto/SEE inspections requiring vehicle lift to inspect under-carriage components or wheel pull were conducted in a bay area to minimize lane flow backup or stoppage. The stopping capability of the brakes after wheel pull was dynamically tested on a slow speed dynamometer.

The facility included a participant reception area and waiting room which contained reading material and a television. The patron could observe the inspection process by closed circuit television or through windows beside the lane.

4. Vehicle Types Inspected: The volunteers for the demonstration were drawn from passenger cars of 1968-1973 make/model sets specified by NHTSA. The vehicles included all major manufacturers of the United States (American Motors, Chrysler, Ford, General Motors) and popular imports (Datsun, Toyota, Volkswagen).

5. Types of Inspection Services: The inspections representative of the facility's capability were those given to the treatment group. The inspections provided to this group included:

   - Brakes - brake equalization test using platform brake tester, front and rear dynamic brake testing using a high-speed dynamometer, wheel pull to examine one front and one rear wheel brake lining material and components, low-speed roller brake tester to verify integrity of the brakes after wheel pull.

   - Exhaust emissions - loaded mode testing for HC and CO levels, condition of exhaust system and components.

   - Engine analysis - cylinder balance, ignition primary, ignition secondary, point dwell, start current draw, charging action.

   - Wheel alignment - automated instrument dynamic reading of caster, camber and toe angles.

- Steering/Suspension - visual inspection of shock absorbers, energy absorbing steering column, springs, ball joints, tie rods, wheel play.

- Tires and wheels - visual inspection of condition of wheels and tires.

- Drive train - visual inspection of transmission, differential and drive shaft.

- Interior - visual inspection of seats, head restraints, rear view mirror, horn, windshield wipers and washer, speedometer, transmission shift lever and indicator.

- Lights - headlight aim inspection by instrument, visual inspection of directional signals, brake lights, stop lights, rear lights, side marker lights.

- Body/chassis - visual inspection of frame, bumpers, doors, fenders, glazing, outside mirror, hood, latches and locks, gas filler cap.

- Reinspection of all failed components.

6. Hours of Operation: 8:00 to 4:00, Monday through Friday.

7. Physical Area of Inspection Facility: The 15,200-square-foot facility housed two lanes for diagnostic inspection, a five-bay area for the demonstration program, two lanes for Chattanooga's PMVI program, a participant waiting room, a counseling area,and staff offices. The diagnostic inspection program took up approximately two-thirds of this area. Outside of the facility in the parking area a shed of approximately 150 square feet was utilized as a dynamic brake test area to verify integrity of the brakes after wheel pull.

8. Inspection Station Dimensions: The area used for the diagnostic inspection demonstration included:

   - Lane area - approximately 42' wide by 112' long

   - Bay area - an area of approximately 28' wide by 96' long,divided into 5 bays.

[redacted]

- An external shed area, approximately 12' wide by 15' long for dynamic brake testing
- Reception and waiting room - an area approximately 21' wide and 25' long was set aside for participant accommodation.

8. Number of Lanes/Bays: The facility contained two lanes, five bays and one shed used for dynamic brake testing.

9. Lane/Bay Dimensions:

   - Lane - approximately 15' wide x 112' long
   - Bay - approximately 12' wide x 25' long
   - Shed - approximately 12' wide x 15' long.

10. Queueing Area: A parking area was provided for the motorist near the reception area for queueing into the inspection lanes. A member of the staff picked up the car and drove it into the facility after the motorist logged in.

11. Parking Area: The parking area could accommodate approximately 12-15 cars.

12. Facility Diagram and Location of Equipment: See Figures 1 and 2.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: 1975.

2. Construction Type and Material: The building was constructed of load bearing pre-cast concrete exterior wall panels and interior load bearing concrete blockwalls.

3. Patron Accommodations: A 21' x 25' reception and waiting room which accommodated 18 people was made available to patrons. Reading materials and TV were available. Patrons could also observe the inspection through windows beside the lane or through closed circuit television in the waiting room.

4. Ventilation: The facility has exhaust fans in the lanes with louvers in the ceiling and ducts at floor levels to permit air circulation.

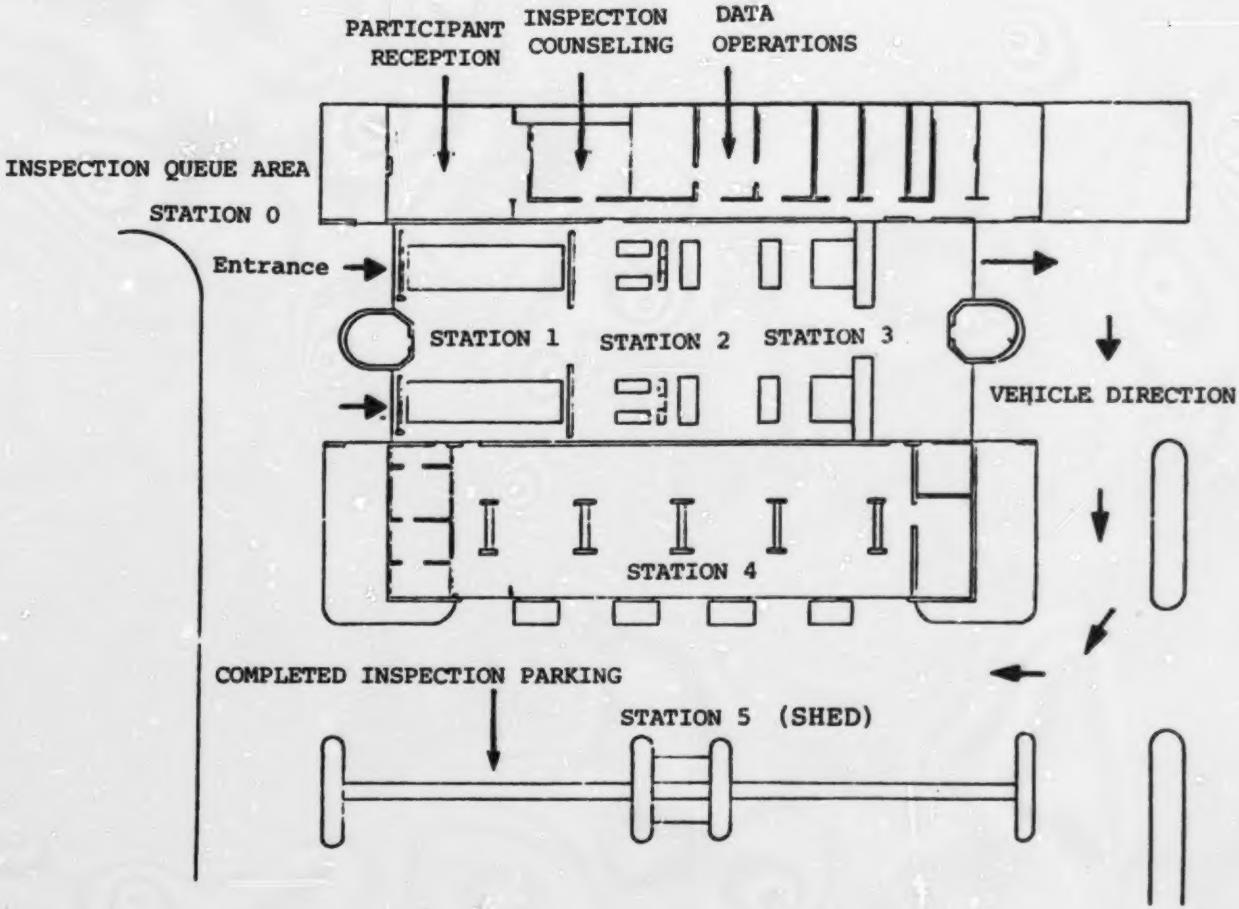

PARTICIPANT RECEPTION
INSPECTION COUNSELING
DATA OPERATIONS
INSPECTION QUEUE AREA
STATION 0
Entrance
STATION 1
STATION 2
STATION 3
VEHICLE DIRECTION
STATION 4
COMPLETED INSPECTION PARKING
STATION 5 (SHED)

FIGURE 1. DIAGNOSTIC INSPECTION PROPERTY LAYOUT

BEST DOCUMENT AVAILABLE

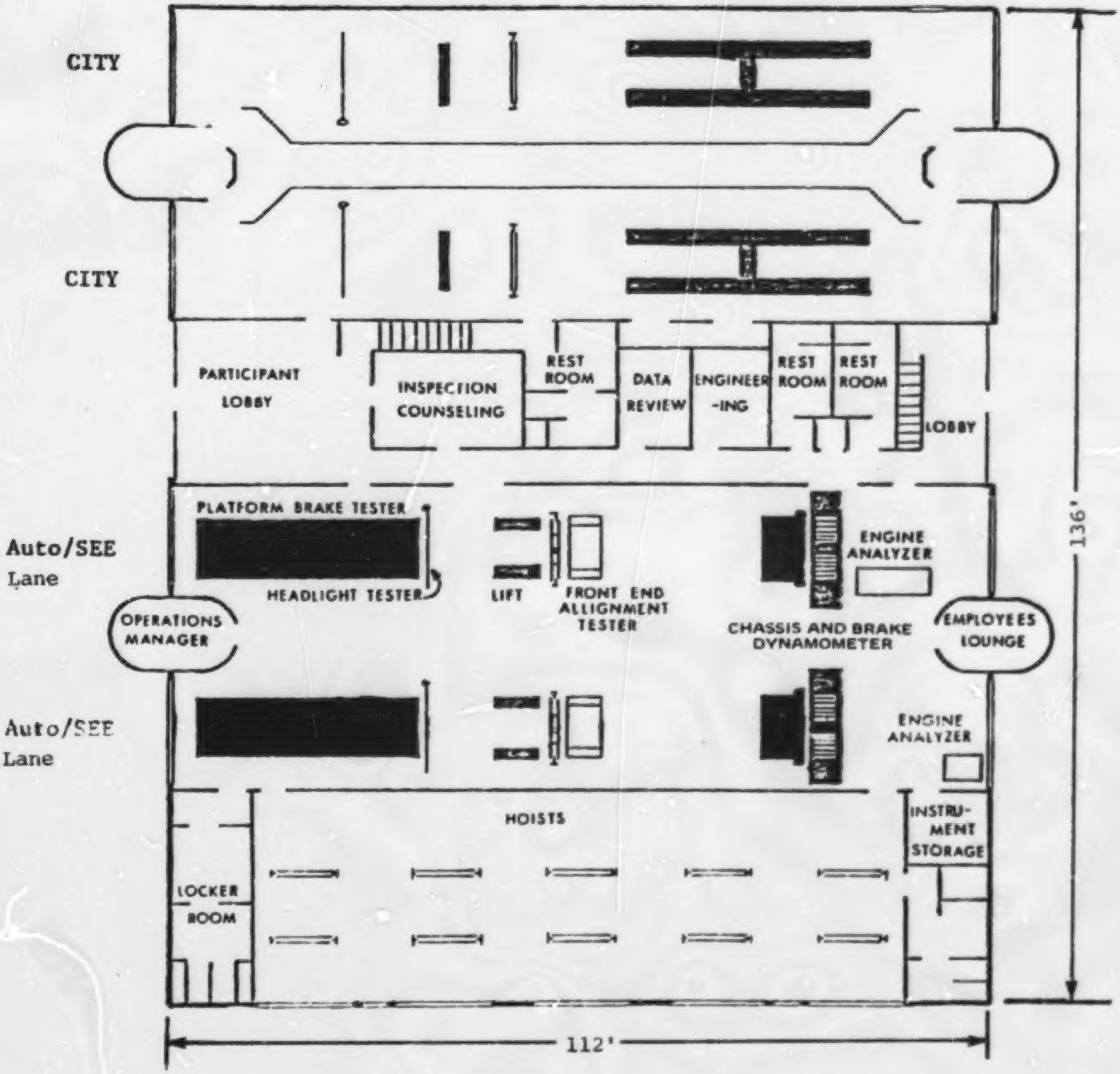

CITY
CITY
PARTICIPANT LOBBY
INSPECTION COUNSELING
REST ROOM
DATA REVIEW
ENGINEER-ING
REST ROOM
REST ROOM
LOBBY
Auto/SEE Lane
PLATFORM BRAKE TESTER
HEADLIGHT TESTER
LIFT
FRONT END ALLIGNMENT TESTER
ENGINE ANALYZER
CHASSIS AND BRAKE DYNAMOMETER
OPERATIONS MANAGER
EMPLOYEES LOUNGE
Auto/SEE Lane
ENGINE ANALYZER
HOISTS
INSTRU-MENT STORAGE
LOCKER ROOM
136'
112'

FIGURE 2. DETAILED LAYOUT OF DIAGNOSTIC LANE

BEST DOCUMENT AVAILABLE

5. Health/Safety/Accommodations: No special consideration except that the patron area was removed from the inspection area by walls which minimized noise and pollution.

6. Noise Accommodations: None.

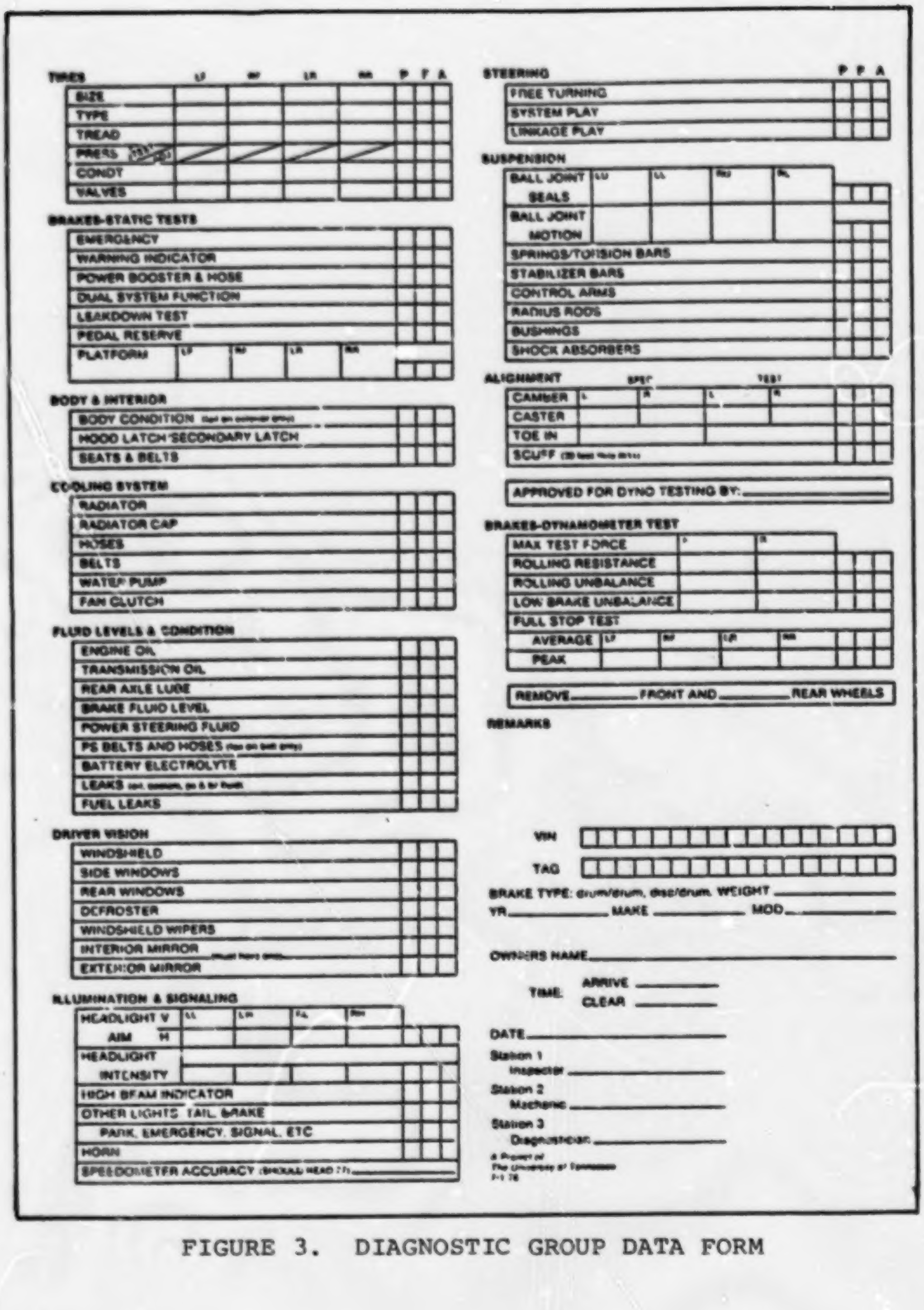
III. STEPS OF INSPECTION PROCESS

1. Check-In - Participant was met at parking area by inspector. The patron was then directed into the reception area where a greeter verified the appointment and obtained the log of maintenance and receipts of repairs (if any). The greeter prepared the inspection forms and gave them to the inspector who met the patron.

2. Test Sequence:

   - Station 0 - The inspector verified VIN number, registration, mileage.
   - Station 1 - Underhood checks (fluid levels, belts, hoses), tires, static brake test, interior visual, lighting systems including headlamps, platform brake test, scuff test, wheel integrity and deformation test.
   - Station 2 - Suspension inspection, steering (free turning, system play, wheel bearing play, ball joint play), wheel alignment.
   - Station 3 - Front and rear brake testing using dynamometer, loaded mode emission tests, engine analysis.
   - Station 4 (bay) - Visual examination of undercarriage, wheel pull to examine one rear and one front brake (drum or disk wear, examination for leaks, thickness of friction material).
   - Station 5 (shed) - Low-speed roller brake tester to verify integrity of brakes after wheel pull.

3. Data Handling: Manual - Figure 3 illustrates the form used to indicate the inspection results of the treatment group. Figure 4 illustrates the inspection form used to report inspection results of the control group.



TIRES

	LF	RF	LR	RR	P	F	A
SIZE							
TYPE							
TREAD							
PRESS							
CONDT							
VALVES							

BRAKES-STATIC TESTS

					P	F	A
EMERGENCY							
WARNING INDICATOR							
POWER BOOSTER & HOSE							
DUAL SYSTEM FUNCTION							
LEAKDOWN TEST							
PEDAL RESERVE							
PLATFORM	LF	RF	LR	RR			

BODY & INTERIOR

	P	F	A
BODY CONDITION			
HOOD LATCH SECONDARY LATCH			
SEATS & BELTS			

COOLING SYSTEM

	P	F	A
RADIATOR			
RADIATOR CAP			
HOSES			
BELTS			
WATER PUMP			
FAN CLUTCH			

FLUID LEVELS & CONDITION

	P	F	A
ENGINE OIL			
TRANSMISSION OIL			
REAR AXLE LUBE			
BRAKE FLUID LEVEL			
POWER STEERING FLUID			
PS BELTS AND HOSES			
BATTERY ELECTROLYTE			
LEAKS			
FUEL LEAKS			

DRIVER VISION

	P	F	A
WINDSHIELD			
SIDE WINDOWS			
REAR WINDOWS			
DEFROSTER			
WINDSHIELD WIPERS			
INTERIOR MIRROR			
EXTERIOR MIRROR			

ILLUMINATION & SIGNALING

						P	F	A
HEADLIGHT AIM	V	LL	LH	RL	RH			
	H							
HEADLIGHT INTENSITY								
HIGH BEAM INDICATOR								
OTHER LIGHTS TAIL, BRAKE PARK, EMERGENCY, SIGNAL, ETC								
HORN								

SPEEDOMETER ACCURACY ______

STEERING

	P	F	A
FREE TURNING			
SYSTEM PLAY			
LINKAGE PLAY			

SUSPENSION

	LU	LL	RU	RL	P	F	A
BALL JOINT SEALS							
BALL JOINT MOTION							
SPRINGS/TORSION BARS							
STABILIZER BARS							
CONTROL ARMS							
RADIUS RODS							
BUSHINGS							
SHOCK ABSORBERS							

ALIGNMENT

	SPEC		TEST		P	F	A
CAMBER	L	R	L	R			
CASTER							
TOE IN							
SCUFF							

APPROVED FOR DYNO TESTING BY: ______

BRAKES-DYNAMOMETER TEST

					P	F	A
MAX TEST FORCE	L	R					
ROLLING RESISTANCE							
ROLLING UNBALANCE							
LOW BRAKE UNBALANCE							
FULL STOP TEST							
AVERAGE	LF	RF	LR	RR			
PEAK							

REMOVE ______ FRONT AND ______ REAR WHEELS

REMARKS

VIN ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

TAG ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

BRAKE TYPE: drum/drum, disc/drum. WEIGHT ______

YR ______ MAKE ______ MOD ______

OWNERS NAME ______

TIME ARRIVE ______

CLEAR ______

DATE ______

Station 1 Inspector ______

Station 2 Mechanic ______

Station 3 Diagnostician ______

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FIGURE 3. DIAGNOSTIC GROUP DATA FORM

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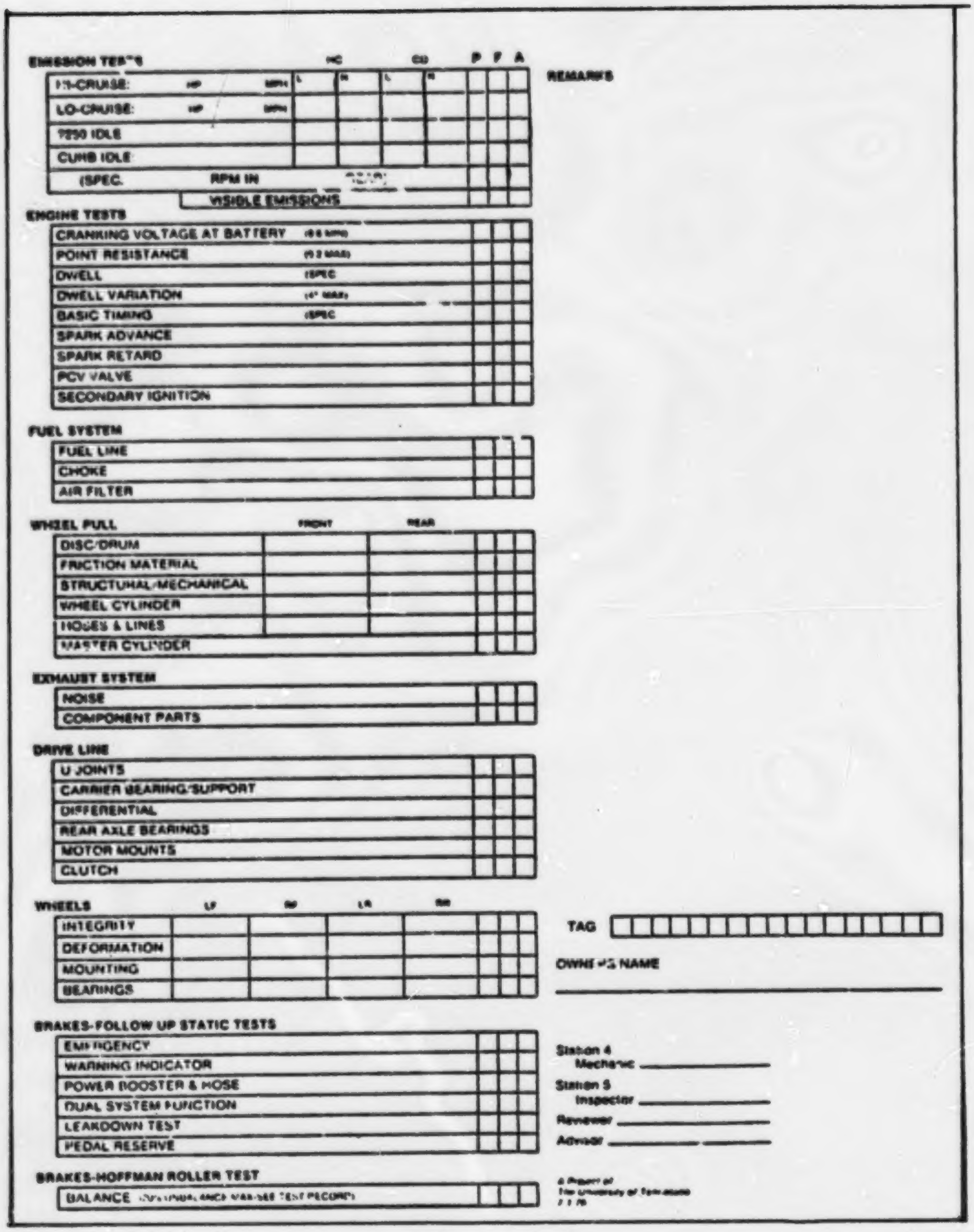

EMISSION TESTS

	HC		CO		P	F	A
HI-CRUISE: HP MPH	L	H	L	H			
LO-CRUISE: HP MPH							
2250 IDLE							
CURB IDLE							
(SPEC. RPM IN [illegible]							
VISIBLE EMISSIONS							

REMARKS

ENGINE TESTS

CRANKING VOLTAGE AT BATTERY	(9.6 MIN)			
POINT RESISTANCE	(0.2 MAX)			
DWELL	(SPEC			
DWELL VARIATION	(4° MAX)			
BASIC TIMING	(SPEC			
SPARK ADVANCE				
SPARK RETARD				
PCV VALVE				
SECONDARY IGNITION				

FUEL SYSTEM

FUEL LINE			
CHOKE			
AIR FILTER			

WHEEL PULL

	FRONT	REAR			
DISC/DRUM					
FRICTION MATERIAL					
STRUCTURAL/MECHANICAL					
WHEEL CYLINDER					
HOSES & LINES					
MASTER CYLINDER					

EXHAUST SYSTEM

NOISE			
COMPONENT PARTS			

DRIVE LINE

U JOINTS			
CARRIER BEARING/SUPPORT			
DIFFERENTIAL			
REAR AXLE BEARINGS			
MOTOR MOUNTS			
CLUTCH			

WHEELS

	LF	RF	LR	RR			
INTEGRITY							
DEFORMATION							
MOUNTING							
BEARINGS							

TAG ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

OWNER'S NAME ____________________

BRAKES-FOLLOW UP STATIC TESTS

EMERGENCY			
WARNING INDICATOR			
POWER BOOSTER & HOSE			
DUAL SYSTEM FUNCTION			
LEAKDOWN TEST			
PEDAL RESERVE			

Station 4
Mechanic ________________
Station 5
Inspector ________________
Reviewer ________________
Advisor ________________

BRAKES-HOFFMAN ROLLER TEST

BALANCE (IMBALANCE VAR-SEE TEST RECORD)			

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[illegible]

FIGURE 3. (Continued)

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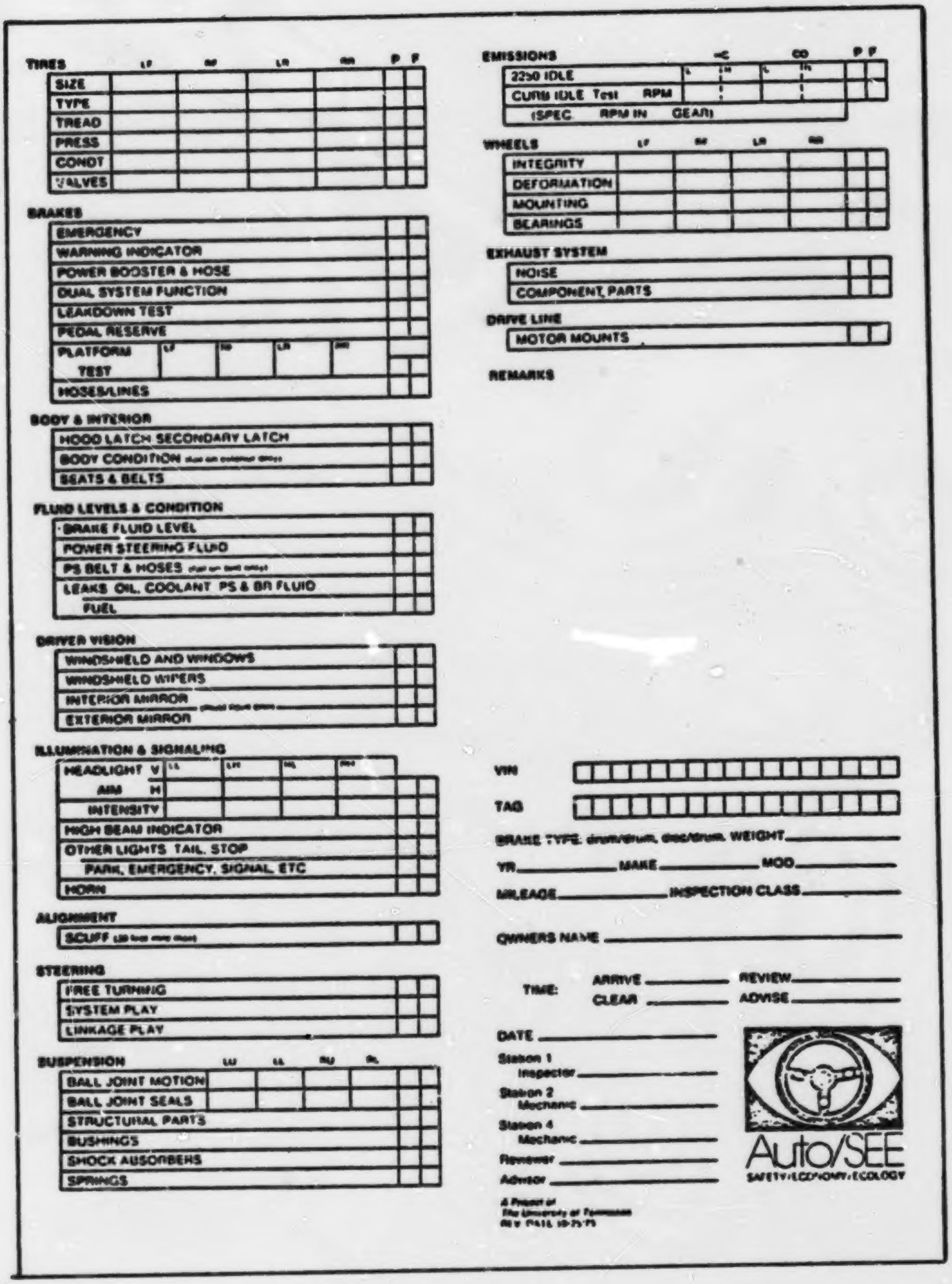

TIRES

	LF	RF	LR	RR	P	F
SIZE						
TYPE						
TREAD						
PRESS						
CONDT						
VALVES						

BRAKES

EMERGENCY						
WARNING INDICATOR						
POWER BOOSTER & HOSE						
DUAL SYSTEM FUNCTION						
LEAKDOWN TEST						
PEDAL RESERVE						
PLATFORM TEST	LF	RF	LR	RR		
HOSES/LINES						

BODY & INTERIOR

HOOD LATCH SECONDARY LATCH		
BODY CONDITION		
SEATS & BELTS		

FLUID LEVELS & CONDITION

BRAKE FLUID LEVEL		
POWER STEERING FLUID		
PS BELT & HOSES		
LEAKS OIL, COOLANT PS & BR FLUID		
FUEL		

DRIVER VISION

WINDSHIELD AND WINDOWS		
WINDSHIELD WIPERS		
INTERIOR MIRROR		
EXTERIOR MIRROR		

ILLUMINATION & SIGNALING

		LL	LH	RL	RH		
HEADLIGHT AIM	V						
	H						
INTENSITY							
HIGH BEAM INDICATOR							
OTHER LIGHTS TAIL, STOP							
PARK, EMERGENCY, SIGNAL, ETC							
HORN							

ALIGNMENT

SCUFF		

STEERING

FREE TURNING		
SYSTEM PLAY		
LINKAGE PLAY		

SUSPENSION

	LU	LL	RU	RL		
BALL JOINT MOTION						
BALL JOINT SEALS						
STRUCTURAL PARTS						
BUSHINGS						
SHOCK ABSORBERS						
SPRINGS						

EMISSIONS

	HC L	HC H	CO L	CO H	P	F
2250 IDLE						
CURB IDLE Test RPM						
(SPEC RPM IN GEAR)						

WHEELS

	LF	RF	LR	RR		
INTEGRITY						
DEFORMATION						
MOUNTING						
BEARINGS						

EXHAUST SYSTEM

NOISE		
COMPONENT PARTS		

DRIVE LINE

MOTOR MOUNTS		

REMARKS

VIN ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

TAG ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

BRAKE TYPE: drum/drum, disc/drum, WEIGHT________

YR________ MAKE________ MOD________

MILEAGE________ INSPECTION CLASS________

OWNERS NAME ________

TIME: ARRIVE ________ REVIEW________

CLEAR ________ ADVISE________

DATE ________

Station 1 Inspector________

Station 2 Mechanic ________

Station 4 Mechanic ________

Reviewer ________

Advisor ________

Auto/SEE
SAFETY/ECONOMY/ECOLOGY

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FIGURE 4. CONTROL GROUP DATA FORM

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4. Check-Out - The inspection form was given to the reviewer after the tests were complete. The reviewer was responsible for (1) checking the form for accuracy and completeness, (2) determining whether the vehicle passed/failed, and (3) determining the incentives (safety sticker and/or trading stamps) due the patron. A copy of the inspection form was placed in the patron's file and given to the service advisor. The service advisor reviewed the inspection results and provided consultation to the patron on significant findings.

IV. FEE

1. Diagnostic Inspection: The diagnostic inspection was free to the participants of the demonstration program. The participants agreed to have repairs performed, return for reinspection (with repair invoices), keep expense records, etc.

2. Other Services: If easily corrected, the headlights were properly aimed free of charge.

V TEST EQUIPMENT

1. Brakes: Each lane contained a Bear Model 47-105 platform brake tester, to measure brake equalization. Each lane contained a Sun Road A-Matic, Model 937-1 to measure peak braking force and imbalances. This dynamometer was also used for loaded emissions inspection. The shed (Station 5) contained a Hofmann Brekon 1 slow speed test stand and analyzer.

2. Alignment: Each lane contained a Weaver Scuff Gauge, Model WJ-132A to measure side slip as well as a Hunter F-60 to measure caster, camber and toe angles. As back-up, the facility had a magnetic caster-camber gauge (Bear Mode 29) and a toe-in gauge (Dunlop AGO/30).

3. Headlight Aim: Each lane contained a Hunter, Model 25-36-2 Headlight Aim Tester.

4. Lifts: Each lane had Globe Special Front End Lift for steering, ball joint play inspection. The bay had three Dresser-Wayne Twin-Post Model FM-8000 for undercarriage inspection and wheel pull.

5. Emission Analyzer: The facility had the following emission analyzers:

   - Beckman Model 590 Exhaust Analyzer

[redacted]

- Horiba, Model GSM-300A Exhaust Analyzer
- Marquette Model 42-159 Exhaust Analyzer
- Sun Model V-912-I Exhaust Analyzer
- Sun Model EPA-75 Exhaust Analyzer
- Emission Analyzer, Part of the Hamilton Standard Autosense.

6. Engine Analyzer: The facility had the following:
   - Marquette Model 40-226 Engine Analyzer
   - Sun Model EET-945 Engine Analyzer
   - Sun Model 2001 Engine Analyzer
   - Hamilton Standard Engine Analyzer.
7. Dynamometer: See brakes.
8. Noise Testing: None.
9. Fuel Economy: None.
10. Backup: The redundancy in equipment permitted backup until repair of down equipment.
11. Technical Library: None.
12. Mobile Equipment: None.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance:

Equipment	Maintenance Schedule*
Wheel Alignment	a) not defined
Toe-in Gauge	a) as required
Caster, Camber Gauge	a) as required
Scuff Gauge	a) monthly
Brake Test Stand	a) not defined
Brake Analyzer	a) as required

---

* Documentation of the detailed maintenance schedule could not be located for this report.

[redacted]

Brake Platform Tester	a) air purge - weekly b) clean - monthly
Chassis dynometer, Sun RAM 937	a) not defined
Engine Analyzer - Clayton	a) not defined
Engine Analyzer - Autosense	a) not defined
Engine Analyzer - Marquette	a) not defined
Exhaust Analyzer - Beckman	a) not defined
Emission Analyzer - Marquette	a) periodic
Emission Analyzer - Autosense	a) not defined
Emission Analyzer - Horiba	a) periodic
Headlight Tester	a) weekly

Equipment	Calibration Schedule
Wheel Alignment - Hunter F-60	a) not defined
Toe-In Gauge - Dunlop AGO/30	a) zero calibration, daily
Scuff Gauge - Weaver-WJ-132	a) calibration, monthly
Caster-Camber Gauge Bear 29	a) weekly
Brake Test Stand - Hofmann Brekon 1	a) not defined
Brake Analyzer - Clayton PB8-CP201R	a) quarterly
Brake Platform Tester Bear 47-105	a) static test, weekly b) dynamic test, bi-weekly
High Speed Roller Brake Tester, SUN RAM-937	a) not defined

[redacted]

Chassis Dynamometer Sun RA, 937	a) not defined
Engine Analyzer - Clayton CSS 5101	a) use discontinued after move to permanent facility - returned to manufacturer
Engine Analyzer - Hamilton Test Systems Autosense	a) monthly
Engine Analyzer - Marquette 40-225	a) monthly
Emission Analyzer - Beckman 590	a) daily
Emission Analyzer - Marquette 42-159	a) daily b) check AIR ADJ between cars
Emission Analyzer - Parts of Autosense (above)	a) daily
Emission Analyzer - Horiba GSM 300A	a) daily
Headlight Tester - Hunter 25-36-2	a) weekly

VII FACILITY STAFFING

There were approximately 60 fulltime positions involved in the Tennessee Project of which approximately 40 were directly involved in the inspection. Those directly involved in the inspection included:

- One lane supervisor for each lane
- One instrumentation engineer
- Eleven inspectors
- Nine mechanics
- Six diagnosticians
- Four reviewers
- Six service advisors
- Four greeters.

VIII. TRAINING

1 Staff Experience:

- Supervisor experience - technician with a minimum of five years automotive mechanic experience
- Inspector experience - technician with a minimum of three years automotive mechanic experience
- Quality control and instrumentation - graduate mechanical engineer.

2. Employee Training: All the inspectors received 24-32 hours of classroom instruction on procedures and equipment and 40 hours on-the-job training. This in-house training was supplemented by periodic training sessions provided by test equipment manufacturers' representatives.

IX. QUALITY CONTROL*

1. Supervision of Inspectors: A lane supervisor continuously monitored the activities of the inspectors in the lane of his responsibility.

2. Surveys of Customer Satisfaction: A random survey of 400 participants was made near the completion of the demonstration to measure attitudes and perceptions of the program utility. Those responding to the survey indicated positive attitudes and strong support. This opinion was shared equally by those who participated in the treatment or control group.

3. Criteria for Failure: Existing local standards, Federal VIU standards, and manufacturers' tolerances were used.

X. REINSPECTION PROCEDURES AND REQUIREMENTS

Initially the participants were asked to return in ten days. To minimize inconvenience, the reinspection schedule became open-ended. Most who returned came within 18 days. The average participant returned for reinspection within 12-13 days. It was necessary to go through the lane flow to be reinspected for a failed item.

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* In addition to the measures cited in this section, all projects were monitored through on-site visits and reviews of procedures and documentation by a Technical Support contractor reporting to NHTSA. Visits were monthly until September 1975, then reduced to quarterly.

[redacted]

XI. CUSTOMER INTERFACE

1. Counseling: While the treatment and control groups did not receive the same level of inspection, they both received information on the findings of the inspection. The diagnosticians advised on potential remedies. They did not estimate the cost of repair or recommend specific repair facilities. The time of counseling for treatment group participants was 17-20 minutes. For control group participants it averaged ten minutes.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: The full inspection and counseling time of a treatment group participant approximated 75 minutes. Approximately 40 minutes of this time was for vehicle inspections. The additional time included the process of checking forms for completeness, counseling, and for participant processing by the receptionist. The inspection time for the control group was approximately 16 minutes. The processing and counseling time for this group was approximately 20 minutes.

2. Time at Each Station in the Lane:

   - Station 0 - 2.3 minutes
   - Station 1 - 9.0 minutes
   - Station 2 - 6.5 minutes
   - Station 3 - 10.3 minutes
   - Station 4 - 9.8 minutes
   - Station 5 - 3.3 minutes

   Total: 41.2 minutes.

   Based on these station times and an estimated efficiency factor of 70 percent, the estimated maximum lane throughput for stations 0 through 3 was 4 vehicles per lane per hour. Actual throughput based on customer demand ranged from 2.6 to 3.8 vehicles per lane per hour.

3. Appointments: Yes.

XIII. CONSUMER AND COMMUNITY RELATIONS

Project Auto/SEE utilized an advertising campaign to make the program known to the general public. The project also met with repair facility representatives to explain their standards for rejection and the instruments used in performing the inspection. The purpose of these meetings was to inform the local industry of the Auto/SEE activity and to stimulate better quality control of their repair processes. The Chattanooga Automobile Club (AAA) also was very supportive of the project. They recommended to their membership, by letter, the use of the facility.

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment:

- Facility
  - Structure: $540,000
  - Land and Improvements: $278,900
- Equipment
  - Major equipment in two lanes, bay, and shed: $158,970
  - Miscellaneous (hand tools, repair parts, etc.): $68,540.

2. Operating Labor Cost: $11,710/month (Inspection process only - not project)

- Labor Rates
  - Diagnostician: $800/month
  - Mechanic: $700/month
  - Inspector: $600/month
  - Reviewer: $600/month
  - Service Advisor: $825/month
  - Instrumentation Engineer: Labor cost not available.
- Supervisor and Administrative Cost - $4,387/month
  - Lane supervisor: $12,000/year
  - Greeters: $525/month
  - Data clerks: $525/month.

[redacted]

APPENDIX D

COOPERATIVE DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

(CO-OP AUTO, INC.)

COOPERATIVE DIAGNOSTIC FACILITY CHARACTERISTICS AND EFFECTIVENESS SUMMARY

I. GENERAL DESCRIPTION

1. Facility Name and Address: Co-op Auto, Inc.
2232 S. Industrial Highway
Ann Arbor, Michigan 48104

2. Contact Name and Number: David R. M. Friedrichs
(313) 769-0220

3. General Description of Facility Type: A full service auto care center owned, financed and operated as a membership cooperative. The organization offers diagnostic inspections, general repair by resident mechanics, self repair facilities and membership discounts on most services. The facility consists of a service shop with 10 bays, a parts storage area, an office and a customer write-up and waiting area. This waiting area is also used as a classroom.

4. Vehicle Types Inspected: Passenger vehicles and light trucks.

5. Types of Inspection Services: Inspection of vehicle systems to the depth specified by the customer. All inspections include a road test. The packaged inspection plans include a:

   - Safety/Trip Inspection (brakes, steering and suspension, engine tuning).
   - Going-off Warranty (Safety systems, lights and gauges, belts/hoses, cooling system, fluid retention, drivetrain, exhaust system, electrical system).
   - Diagnostic Special (steering and suspension, drivetrain, exhaust system, brake linings, cooling system, engine tuning, electrical system).
   - Full Diagnostic (similar to Diagnostic Special with cylinder compression test added).

[redacted]

6. Hours of Operation:

   - Service Dept: Monday-Thursday 7:30 a.m. to 6:30 p.m.; Friday 7:30 a.m. to 5 p.m. (flex day, based on service demand).

   - Self-repair & tutoring: Saturday and Sunday 9 a.m. to 7 p.m.: Friday 5 p.m. to 11 p.m.

   - Road service & towing: 24 hours/day, 7 days per week.

7. Physical Area of Inspection Facility: A 4800-square-foot building on a 2-acre tract of land.

8. Inspection Station Dimensions: The service shop where both inspections and repairs are conducted is 72' x 50'.

9. Number of Lanes/Bays: 10 bays.

10. Dimension of Bay: Approximately 18' x 12'.

11. Queueing Area: Vehicles wait in the parking area.

12. Parking Area: For every service area there are three parking spaces available. Each parking area is approximately 500 square feet. Additional area is available for parking if necessary.

13. Facility Diagram: See Figure 1.

II. FACILITY ARCHITECTURAL CHARACTERISTICS

1. Year Constructed: Constructed in 1968 as a library warehouse. Remodeled for present usage in 1973.

2. Construction Type and Material: Steel frame.

3. Patron Accommodation in Addition to Lanes: A small customer waiting area adjacent to the service desk and cashier is available. Most customers leave the vehicle at the facility rather than wait for service or inspection.

4. Ventilation System Design: Exhaust extraction through underfloor tubing. Flexible hoses connected to exhaust to ventilate out through this exhaust pipe.

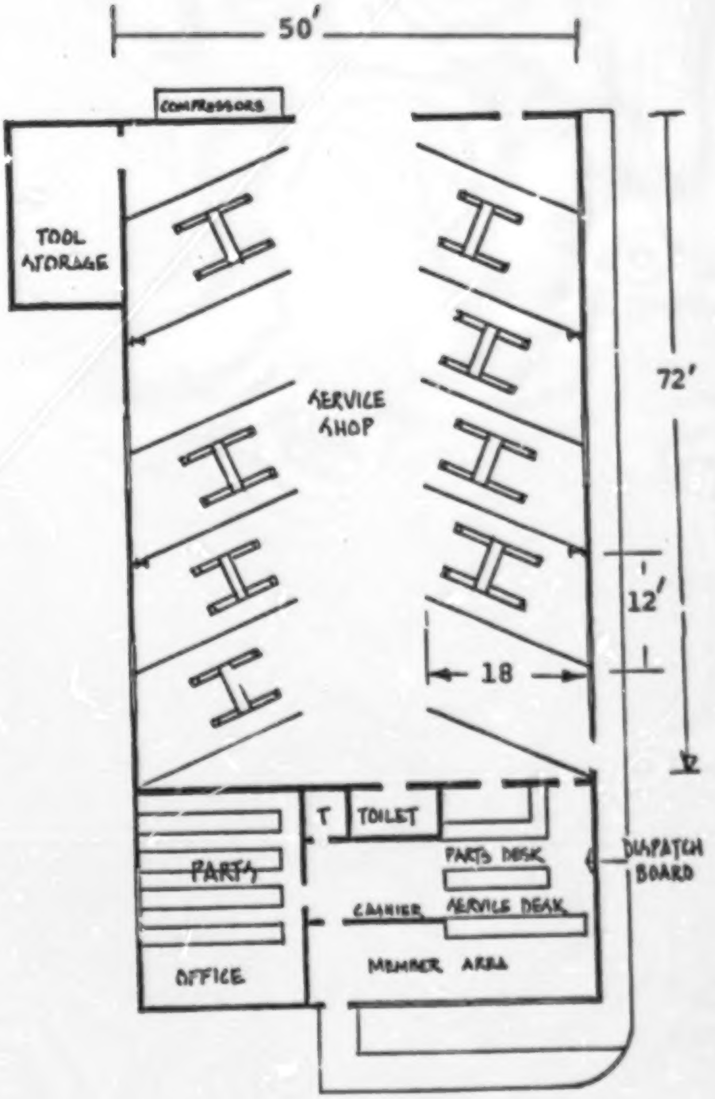

50'
COMPRESSORS
TOOL STORAGE
SERVICE SHOP
72'
12'
18
T
TOILET
PARTS DESK
DISPATCH BOARD
PARTS
CASHIER
SERVICE DESK
OFFICE
MEMBER AREA

FIGURE 1. SERVICE AREA FLOOR PLAN OF CO-OP AUTO

BEST DOCUMENT AVAILABLE

5. Safety Accommodations: Normal automotive shop practices are enforced.

6. Noise Accommodations: No structural accommodations. Ear protection is occasionally used.

III. STEPS OF INSPECTION PROCESS

1. Check-In: Customer interfaces with the service manager for all services.

2. Data Handling: Manual.

3. Check-Out:

   - Customer receives consultation on inspection results from the service manager.

   - A diagnostic inspection with test checkoff and estimated cost of repair is provided (See Figure 2).

   - A record of service and repair (See Figure 3) is kept in member's file.

IV. FEE

1. Several inspections are available at different prices.

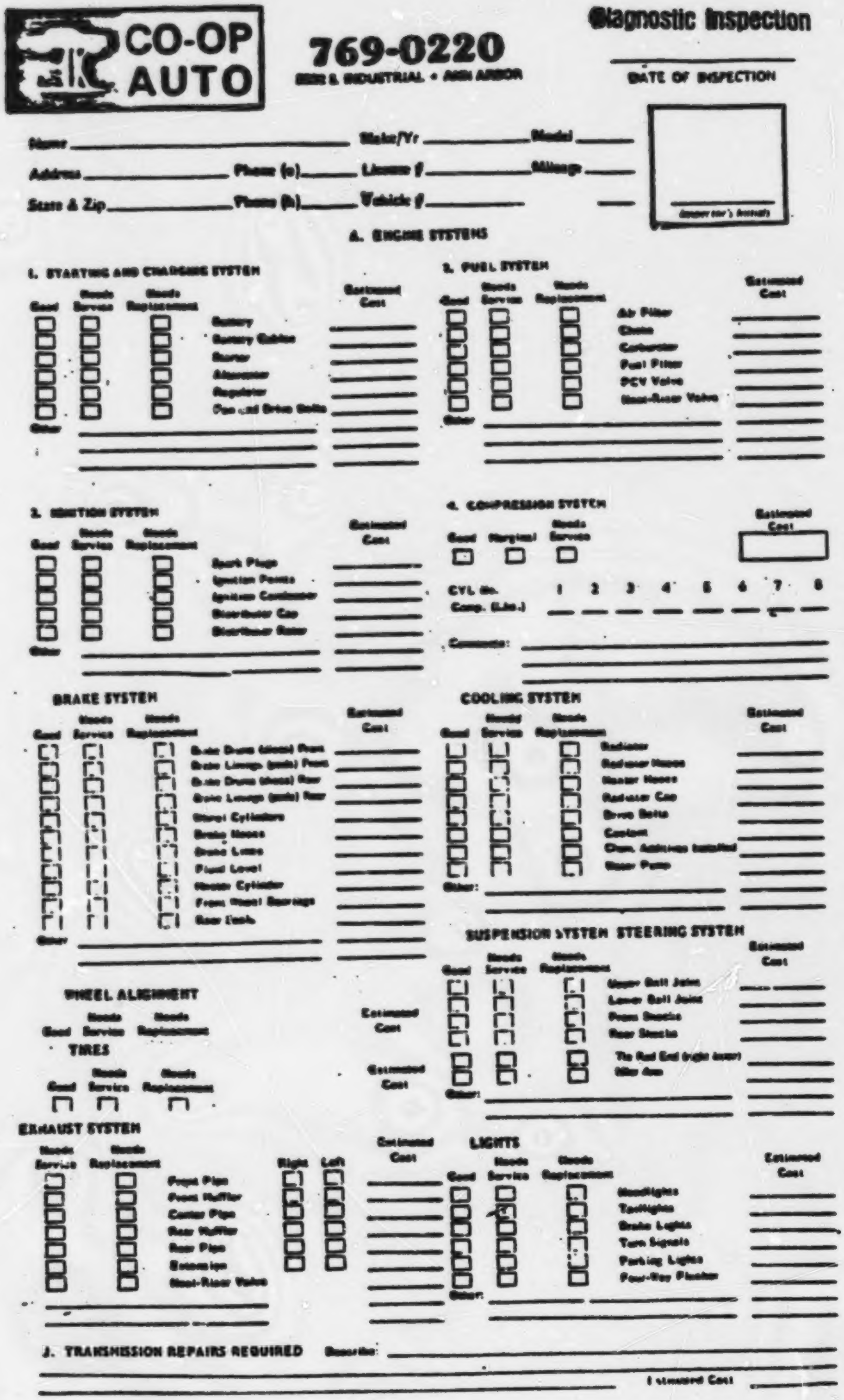
   - Safety Trip: $20-30

   - Going-off Warranty: $20-30

   - Diagnostic Special: $15-25

   - Full Diagnostic: $25-65 ($25 for 4 cylinder vehicle; $30 for 6-cylinder vehicle; $65 for 8-cylinder vehicle with air conditioner).

(1) FULL DIAGNOSTIC



CO-OP AUTO

769-0220

[illegible] S. INDUSTRIAL • ANN ARBOR

Diagnostic Inspection

______ DATE OF INSPECTION

Name ______ Make/Yr ______ Model ______

Address ______ Phone (o) ______ License # ______ Mileage ______

State & Zip ______ Phone (h) ______ Vehicle # ______

______ Inspector's Initials

A. ENGINE SYSTEMS

1. STARTING AND CHARGING SYSTEM

Good	Needs Service	Needs Replacement		Estimated Cost
☐	☐	☐	Battery	______
☐	☐	☐	Battery Cables	______
☐	☐	☐	Starter	______
☐	☐	☐	Alternator	______
☐	☐	☐	Regulator	______
☐	☐	☐	Fan and Drive Belts	______

Other ______

2. FUEL SYSTEM

Good	Needs Service	Needs Replacement		Estimated Cost
☐	☐	☐	Air Filter	______
☐	☐	☐	Choke	______
☐	☐	☐	Carburetor	______
☐	☐	☐	Fuel Filter	______
☐	☐	☐	PCV Valve	______
☐	☐	☐	Heat-Riser Valve	______

Other ______

3. IGNITION SYSTEM

Good	Needs Service	Needs Replacement		Estimated Cost
☐	☐	☐	Spark Plugs	______
☐	☐	☐	Ignition Points	______
☐	☐	☐	Ignition Condenser	______
☐	☐	☐	Distributor Cap	______
☐	☐	☐	Distributor Rotor	______

Other ______

4. COMPRESSION SYSTEM

Good	Marginal	Needs Service	Estimated Cost
☐	☐	☐	☐

CYL. No.	1	2	3	4	5	6	7	8
Comp. (Lbs.)	___	___	___	___	___	___	___	___

Comments: ______

BRAKE SYSTEM

Good	Needs Service	Needs Replacement		Estimated Cost
☐	☐	☐	Brake Drums (shoes) Front	______
☐	☐	☐	Brake Linings (pads) Front	______
☐	☐	☐	Brake Drums (shoes) Rear	______
☐	☐	☐	Brake Linings (pads) Rear	______
☐	☐	☐	Wheel Cylinders	______
☐	☐	☐	Brake Hoses	______
☐	☐	☐	Brake Lines	______
☐	☐	☐	Fluid Level	______
☐	☐	☐	Master Cylinder	______
☐	☐	☐	Front Wheel Bearings	______
☐	☐	☐	Rear Seals	______

Other ______

COOLING SYSTEM

Good	Needs Service	Needs Replacement		Estimated Cost
☐	☐	☐	Radiator	______
☐	☐	☐	Radiator Hoses	______
☐	☐	☐	Heater Hoses	______
☐	☐	☐	Radiator Cap	______
☐	☐	☐	Drive Belts	______
☐	☐	☐	Coolant	______
☐	☐	☐	Chem. Additives Installed	______
☐	☐	☐	Water Pump	______

Other: ______

SUSPENSION SYSTEM STEERING SYSTEM

Good	Needs Service	Needs Replacement		Estimated Cost
☐	☐	☐	Upper Ball Joint	______
☐	☐	☐	Lower Ball Joint	______
☐	☐	☐	Front Shocks	______
☐	☐	☐	Rear Shocks	______
☐	☐	☐	Tie Rod End [illegible]	______
☐	☐	☐	Idler Arm	______

Other: ______

WHEEL ALIGNMENT

Good	Needs Service	Needs Replacement	Estimated Cost

TIRES

Good	Needs Service	Needs Replacement	Estimated Cost
☐	☐	☐	

EXHAUST SYSTEM

Needs Service	Needs Replacement		Right	Left	Estimated Cost
☐	☐	Front Pipe	☐	☐	______
☐	☐	Front Muffler	☐	☐	______
☐	☐	Center Pipe	☐	☐	______
☐	☐	Rear Muffler	☐	☐	______
☐	☐	Rear Pipe	☐	☐	______
☐	☐	Extension	☐	☐	______
☐	☐	Heat-Riser Valve			______

LIGHTS

Good	Needs Service	Needs Replacement		Estimated Cost
☐	☐	☐	Headlights	______
☐	☐	☐	Taillights	______
☐	☐	☐	Brake Lights	______
☐	☐	☐	Turn Signals	______
☐	☐	☐	Parking Lights	______
☐	☐	☐	Four-Way Flasher	______

Other: ______

J. TRANSMISSION REPAIRS REQUIRED Describe: ______

Estimated Cost ______

FIGURE 2. TEST CHECKLIST FOR FULL DIAGNOSTIC INSPECTION

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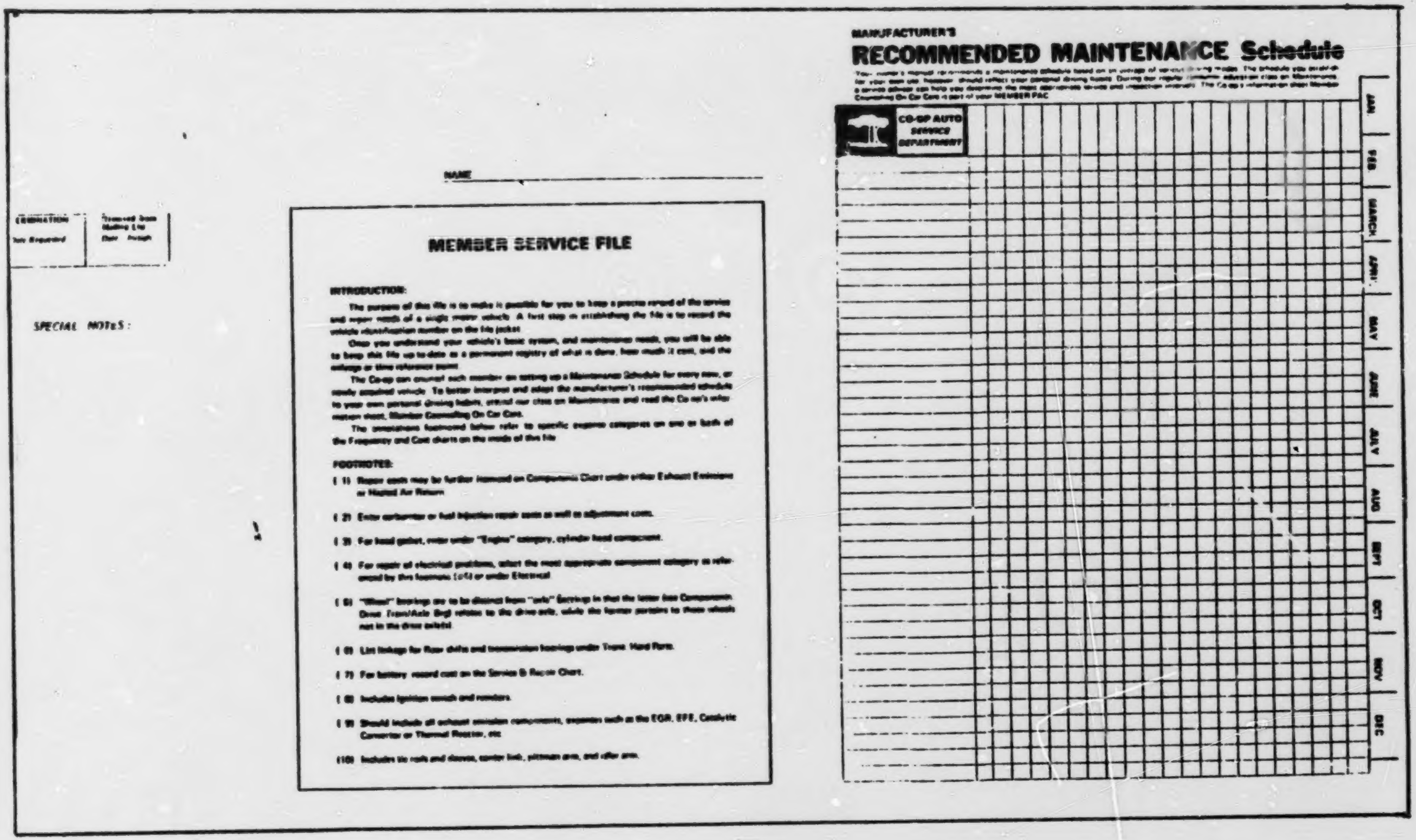

NAME

SPECIAL NOTES:

MEMBER SERVICE FILE

INTRODUCTION:

The purpose of this file is to make it possible for you to keep a precise record of the service and repair needs of a single motor vehicle. A first step in establishing the file is to record the vehicle identification number on the file jacket.

Once you understand your vehicle's basic system, and maintenance needs, you will be able to keep this file up-to-date as a permanent registry of what is done, how much it cost, and the mileage or time reference point.

The Co-op can counsel each member on setting up a Maintenance Schedule for every new, or newly acquired vehicle. To better interpret and adapt the manufacturer's recommended schedule to your own personal driving habits, attend our class on Maintenance and read the Co-op's information sheet, Member Counselling On Car Care.

The annotations footnoted below refer to specific expense categories on one or both of the Frequency and Cost charts on the inside of this file.

FOOTNOTES:

(1) Repair costs may be further itemized on Components Chart under either Exhaust Emissions or Heated Air Return.

(2) Enter carburetor or fuel injection repair costs as well as adjustment costs.

(3) For head gasket, enter under "Engine" category, cylinder head component.

(4) For repair of electrical problems, select the most appropriate component category as referenced by this footnote (4) or under Electrical.

(5) "Wheel" bearings are to be distinct from "axle" bearings in that the latter (see Components: Drive Train/Axle Brg) relates to the drive axle, while the former pertains to those wheels not in the drive axle(s).

(6) List linkage for floor shifts and transmission bearings under Trans. Hard Parts.

(7) For battery, record cost on the Service & Repair Chart.

(8) Includes ignition switch and [illegible].

(9) Should include all exhaust emission components, expenses such as the EGR, EFE, Catalytic Converter or Thermal Reactor, etc.

(10) Includes tie rods and sleeves, center link, pitman arm, and idler arm.

MANUFACTURER'S

RECOMMENDED MAINTENANCE Schedule

CO-OP AUTO SERVICE DEPARTMENT

JAN.
FEB.
MARCH
APRIL
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC

FIGURE 3. RECORD OF SERVICE AND REPAIR

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2. Other Services:

- Repair by mechanics - flat rate charge ($25/hr. for co-op members; $30/hr. for non-members).
- Memberships - lifetime - $100
- Weekend stall rental - $4-5 per hour plus $10/year membership to U-Do-It Club.
- Special tool rental - variable (examples: scope - $8; spin balance - $2/wheel; set point dwell and timing - $2 etc.)

V. TEST EQUIPMENT

1. Brakes: No dynamic equipment (brakes inspected by wheel pull and micrometer use as needed).

2. Alignment: None (visual inspection).

3. Headlight Aim: None (A/C Delco aimer for corrective work).

4. Lift: 8 lifts are used at the Co-op:

   - 5 Globe dual-post (procured in 1973)
   - 1 Globe single-post (procured in 1975)
   - 2 Rotary dual-post (procured in 1976).

5. Emissions Analyzers: (2) Sun portable Infrared Tester, Model A.E.T. 330 (procured in 1977).

6. Engine Analyzer:

   - (1) Sun 747 (remodeled with induction pickup) oscilloscope unit.
   - (2) Sun T.U.T. 915 portable units.

7. Dynamometer: None.

8. Noise Testing: None.

9. Fuel Economy: Part of engine analysis procedure.

[redacted]

10. Other:

- (2) Electrical System testers (SUN VAT-40; SUN VAT-28).
- (1) Fuel injection pressure tester - Bosch
- (1) Distributor tester
- Alignment services to be added in 1981.

11. Plans for Replacement: One portable scope used in engine tuning to be replaced and upgraded in 1980/81.

12. Back-Up Provisions: The Co-op has multiple units of all key analysis equipment.

13. Technical Library:

- Chilton Annual Service Manual and Labor Guide
- Mitchell Parts and Labor Guide
- Chek-Chart Service Bulletins.

14. Mobile Equipment: No mobile diagnostic inspection equipment.

VI. EQUIPMENT MAINTENANCE

1. Frequency of Equipment Maintenance: No regular maintenance schedule. The equipment is repaired when it is broken or malfunctions.

2. Frequency of Gas Calibration for Emissions Analyzer: SUN serviceman inspects units at least twice a year.

VII. FACILITY STAFFING

1. Program Director: (1) David Friedrichs.

2. Station Manager: (1) Service Manager and (1) Foreman. (They handle service writing and interchange jobs during the day).

3. Master Mechanics: (10) certified NIASE mechanics.

4. Junior Mechanics: (2) apprentice mechanics.

5. Diagnosticians: None (The master mechanics assume this role).

6. Other:

   - (2) Parts department staff
   - (1) Secretary/clerk
   - (1) Driver.

VIII. TRAINING

1. Inspection Experience: NIASE certified mechanics, each a designated specialist in the vehicles of a single manufacturer.

2. Employee Training Provisions: None.

3. Technical Update Meetings: Random - not scheduled.

IX. QUALITY CONTROL

1. Supervision of Mechanics: Foreman and Service Manager supervise mechanics.

2. Surveys of Customer Satisfaction: Annual questionnaire sent to all members.

3. Criteria for Failure: Mitchell; Chilton; and Manufacturer's specifications.

X. REINSPECTION PROCEDURES

There is no formal procedure. The Co-op will reinspect without charge if there is a question of its repair work.

XI. CUSTOMER INTERFACE

1. Counseling: The service writer who initiated the Inspection activity reviews the inspection results with the customer. This consultation may take up to 20 minutes.

2. Additional Customer Services: Self-service repair utilization of space and equipment (for a fee) and tutoring if desired. The classes provide basic instruction on automotive physics and self-service maintenance.

XII. STATION VEHICLE PROCESSING CAPABILITY

1. Processing Time per Vehicle: Approximately 60 minutes for the full diagnostic inspection.

2. Time at Station:

   - Hoist and visual inspection - brakes, suspension, etc. - 20 minutes.

   - Engine, emission and electrical system - 30 minutes.

   - Visual inspection (belts/hoses, lights and gauges, etc.) - 5 minutes.

   - Road test - 5 minutes.

3. Theoretical Maximum Inspection Throughput: Dependent on the mix of inspection options being chosen by the customers. Eight per hour for full diagnostic inspection.

4. Average Lane Throughput: 2 vehicles per day per bay (repairs and inspections).

5. Appointments Used: Yes.

6. Busiest Time of Year: March and fall months.

7. Maximum Number of Vehicles Processed for the Entire Facility: Dependent on the mix of type of inspection and the number of vehicles under repair. Theoretically, if only full diagnostic inspections were given and all of the facilities space and resources were utilized, 60 vehicles could be inspected per day.

XIII. CONSUMER AND COMMUNITY RELATIONS

Education courses on automotive physics, car maintenance and repair are provided to consumers once a week.

[redacted]

XIV. INVESTMENT AND OPERATING COSTS

1. Initial Facility Investment:

   - Structure improvement - sweat equity (The Co-op employees improved the facility -- a volunteer effort.)

   - Equipment - approximately $50,000.

2. Current Average Hourly Labor Rate:

   - Rate earned by master mechanics - $10-12/hour
   - Mechanic retail rate - $20-25/hour.

3. Operating Costs: The Co-op has an annual budget of $750,000; 90 percent of this related to service and repair work and 10 percent to do-it-yourself and education. The diagnostic and inspection work accounts for approximately 10-15 percent of all billed labor, sometimes in the order of 25 hours per week. It is estimated that 1/2-2/3 of all inspection work is done in conjunction with (or prior to) additional service or repair.

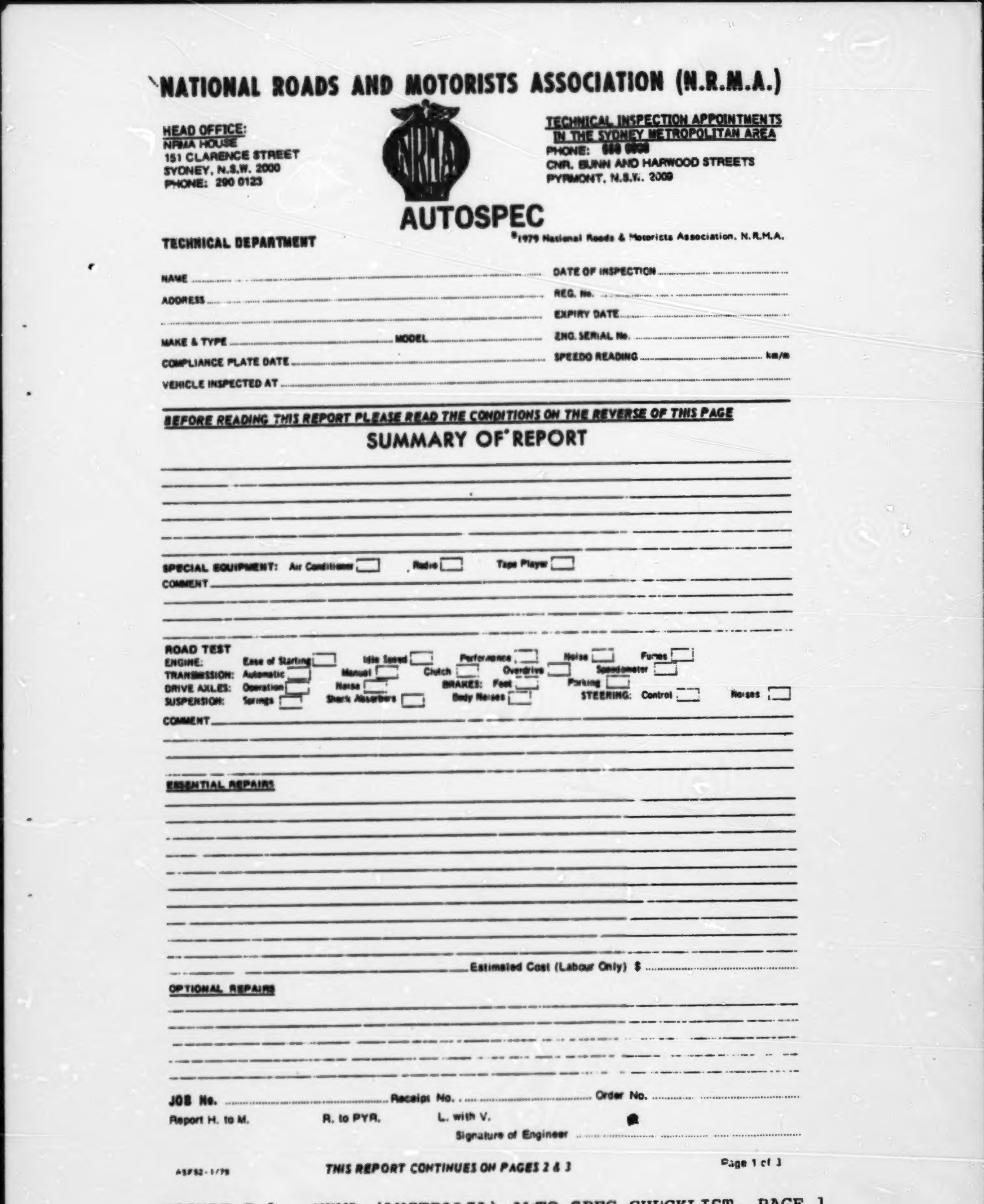
[redacted]

APPENDIX E

FOREIGN AUTO CLUB DIAGNOSTIC INSPECTION FORMS

Page Number

Australia E-1
Austria E-13
Germany E-15
Netherlands E-24
New Zealand E-27



NATIONAL ROADS AND MOTORISTS ASSOCIATION (N.R.M.A.)

HEAD OFFICE:
NRMA HOUSE
151 CLARENCE STREET
SYDNEY, N.S.W. 2000
PHONE: 290 0123

TECHNICAL INSPECTION APPOINTMENTS
IN THE SYDNEY METROPOLITAN AREA
PHONE: [illegible]
CNR. BUNN AND HARWOOD STREETS
PYRMONT, N.S.W. 2009

AUTOSPEC

TECHNICAL DEPARTMENT

©1979 National Roads & Motorists Association, N.R.M.A.

NAME ....

DATE OF INSPECTION ....

ADDRESS ....

....

REG. No. ....

EXPIRY DATE ....

MAKE & TYPE .... MODEL ....

ENG. SERIAL No. ....

COMPLIANCE PLATE DATE ....

SPEEDO READING .... km/m

VEHICLE INSPECTED AT ....

BEFORE READING THIS REPORT PLEASE READ THE CONDITIONS ON THE REVERSE OF THIS PAGE

SUMMARY OF REPORT

____

____

____

____

____

____

SPECIAL EQUIPMENT: Air Conditioner ☐ Radio ☐ Tape Player ☐

COMMENT ____

____

____

____

ROAD TEST

ENGINE: Ease of Starting ☐ Idle Speed ☐ Performance ☐ Noise ☐ Fumes ☐

TRANSMISSION: Automatic ☐ Manual ☐ Clutch ☐ Overdrive ☐ Speedometer ☐

DRIVE AXLES: Operation ☐ Noise ☐ BRAKES: Foot ☐ Parking ☐

SUSPENSION: Springs ☐ Shock Absorbers ☐ Body Noises ☐ STEERING: Control ☐ Noises ☐

COMMENT ____

____

____

____

ESSENTIAL REPAIRS

____

____

____

____

____

____

____

____

____

____

____

______________________________ Estimated Cost (Labour Only) $ ....

OPTIONAL REPAIRS

____

____

____

____

____

____

JOB No. .... Receipt No. .... Order No. ....

Report H. to M. R. to PYR. L. with V.

Signature of Engineer ....

ASF52-1/79

THIS REPORT CONTINUES ON PAGES 2 & 3

Page 1 of 3

FIGURE E-1. NRMA (AUSTRALIA) AUTO SPEC CHECKLIST, PAGE 1

[redacted]

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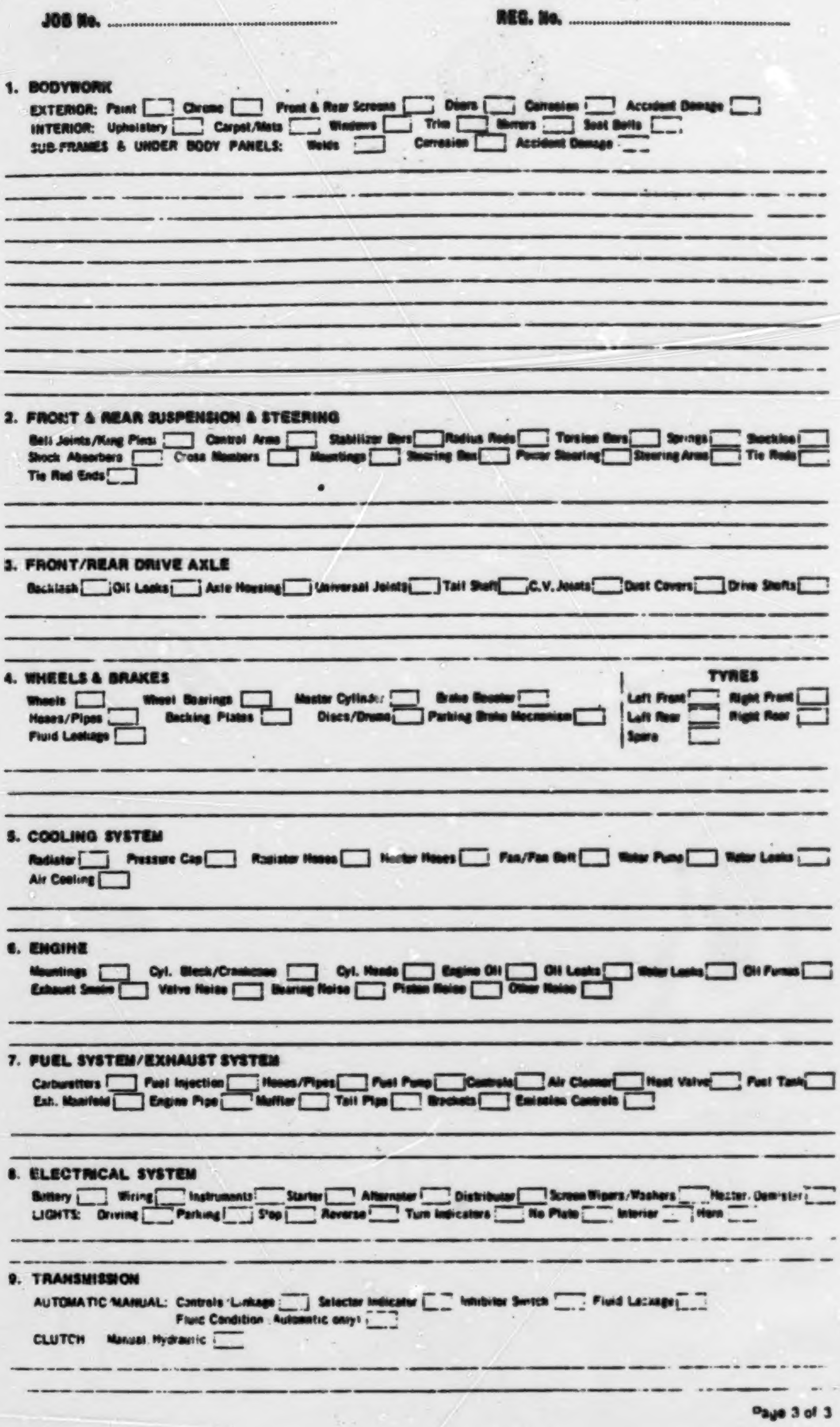

JOB No. ....

REG. No. ....

1. BODYWORK

EXTERIOR: Paint ☐ Chrome ☐ Front & Rear Screens ☐ Doors ☐ Corrosion ☐ Accident Damage ☐
INTERIOR: Upholstery ☐ Carpet/Mats ☐ Windows ☐ Trim ☐ Mirrors ☐ Seat Belts ☐
SUB-FRAMES & UNDER BODY PANELS: Welds ☐ Corrosion ☐ Accident Damage ☐

2. FRONT & REAR SUSPENSION & STEERING

Ball Joints/King Pins ☐ Control Arms ☐ Stabilizer Bars ☐ Radius Rods ☐ Torsion Bars ☐ Springs ☐ Shackles ☐
Shock Absorbers ☐ Cross Members ☐ Mountings ☐ Steering Box ☐ Power Steering ☐ Steering Arms ☐ Tie Rods ☐
Tie Rod Ends ☐

3. FRONT/REAR DRIVE AXLE

Backlash ☐ Oil Leaks ☐ Axle Housing ☐ Universal Joints ☐ Tail Shaft ☐ C.V. Joints ☐ Dust Covers ☐ Drive Shafts ☐

4. WHEELS & BRAKES

Wheels ☐ Wheel Bearings ☐ Master Cylinder ☐ Brake Booster ☐
Hoses/Pipes ☐ Backing Plates ☐ Discs/Drums ☐ Parking Brake Mechanism ☐
Fluid Leakage ☐

TYRES

Left Front ☐ Right Front ☐
Left Rear ☐ Right Rear ☐
Spare ☐

5. COOLING SYSTEM

Radiator ☐ Pressure Cap ☐ Radiator Hoses ☐ Heater Hoses ☐ Fan/Fan Belt ☐ Water Pump ☐ Water Leaks ☐
Air Cooling ☐

6. ENGINE

Mountings ☐ Cyl. Block/Crankcase ☐ Cyl. Heads ☐ Engine Oil ☐ Oil Leaks ☐ Water Leaks ☐ Oil Fumes ☐
Exhaust Smoke ☐ Valve Noise ☐ Bearing Noise ☐ Piston Noise ☐ Other Noise ☐

7. FUEL SYSTEM/EXHAUST SYSTEM

Carburettors ☐ Fuel Injection ☐ Hoses/Pipes ☐ Fuel Pump ☐ Controls ☐ Air Cleaner ☐ Heat Valve ☐ Fuel Tank ☐
Exh. Manifold ☐ Engine Pipe ☐ Muffler ☐ Tail Pipe ☐ Brackets ☐ Emission Controls ☐

8. ELECTRICAL SYSTEM

Battery ☐ Wiring ☐ Instruments ☐ Starter ☐ Alternator ☐ Distributor ☐ Screen Wipers/Washers ☐ Heater/Demister ☐
LIGHTS: Driving ☐ Parking ☐ Stop ☐ Reverse ☐ Turn Indicators ☐ No Plate ☐ Interior ☐ Horn ☐

9. TRANSMISSION

AUTOMATIC/MANUAL: Controls/Linkage ☐ Selector Indicator ☐ Inhibitor Switch ☐ Fluid Leakage ☐
Fluid Condition (Automatic only) ☐
CLUTCH Manual/Hydraulic ☐

Page 3 of 3

FIGURE E-1. NRMA AUTO SPEC CHECKLIST CONTINUED

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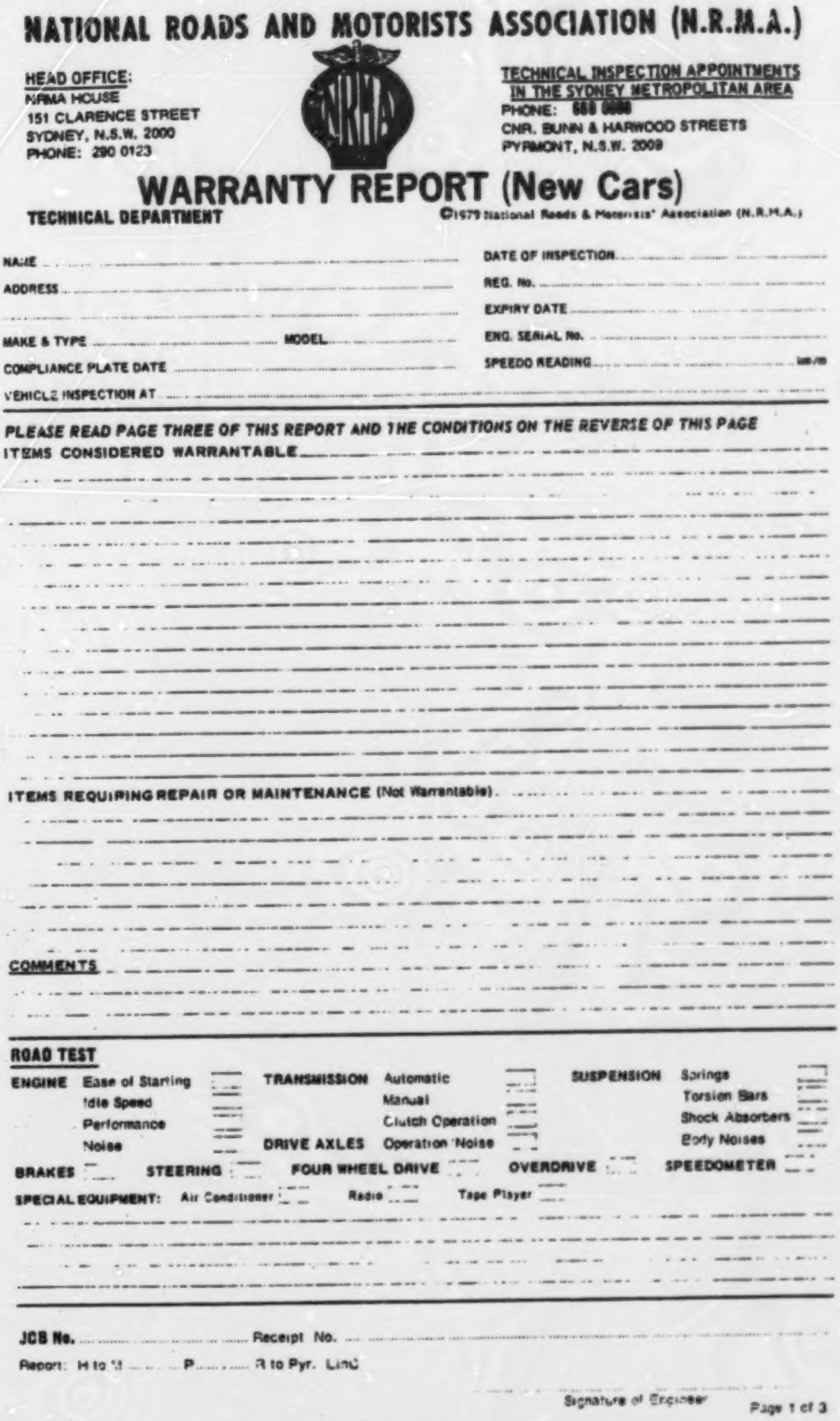

NATIONAL ROADS AND MOTORISTS ASSOCIATION (N.R.M.A.)

HEAD OFFICE:
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151 CLARENCE STREET
SYDNEY, N.S.W. 2000
PHONE: 290 0123

TECHNICAL INSPECTION APPOINTMENTS IN THE SYDNEY METROPOLITAN AREA
PHONE: 688 [illegible]
CNR. BUNN & HARWOOD STREETS
PYRMONT, N.S.W. 2009

WARRANTY REPORT (New Cars)

TECHNICAL DEPARTMENT

©1979 National Roads & Motorists' Association (N.R.M.A.)

NAME ....
ADDRESS ....
....
MAKE & TYPE .... MODEL ....
COMPLIANCE PLATE DATE ....
VEHICLE INSPECTION AT ....

DATE OF INSPECTION ....
REG. No. ....
EXPIRY DATE ....
ENG. SERIAL No. ....
SPEEDO READING .... km/m

PLEASE READ PAGE THREE OF THIS REPORT AND THE CONDITIONS ON THE REVERSE OF THIS PAGE

ITEMS CONSIDERED WARRANTABLE ____________________

ITEMS REQUIRING REPAIR OR MAINTENANCE (Not Warrantable) ____________________

COMMENTS ____________________

ROAD TEST

ENGINE	Ease of Starting	☐	**TRANSMISSION**	Automatic	☐	**SUSPENSION**	Springs	☐
	Idle Speed	☐		Manual	☐		Torsion Bars	☐
	Performance	☐		Clutch Operation	☐		Shock Absorbers	☐
	Noise	☐	**DRIVE AXLES**	Operation Noise	☐		Body Noises	☐

BRAKES ☐ **STEERING** ☐ **FOUR WHEEL DRIVE** ☐ **OVERDRIVE** ☐ **SPEEDOMETER** ☐

SPECIAL EQUIPMENT: Air Conditioner ☐ Radio ☐ Tape Player ☐

____

JOB No. .... Receipt No. ....
Report: H to M .... P.......... R to Pyr. LinC

....
Signature of Engineer

Page 1 of 3

FIGURE E-2. NRMA WARRANTY REPORT

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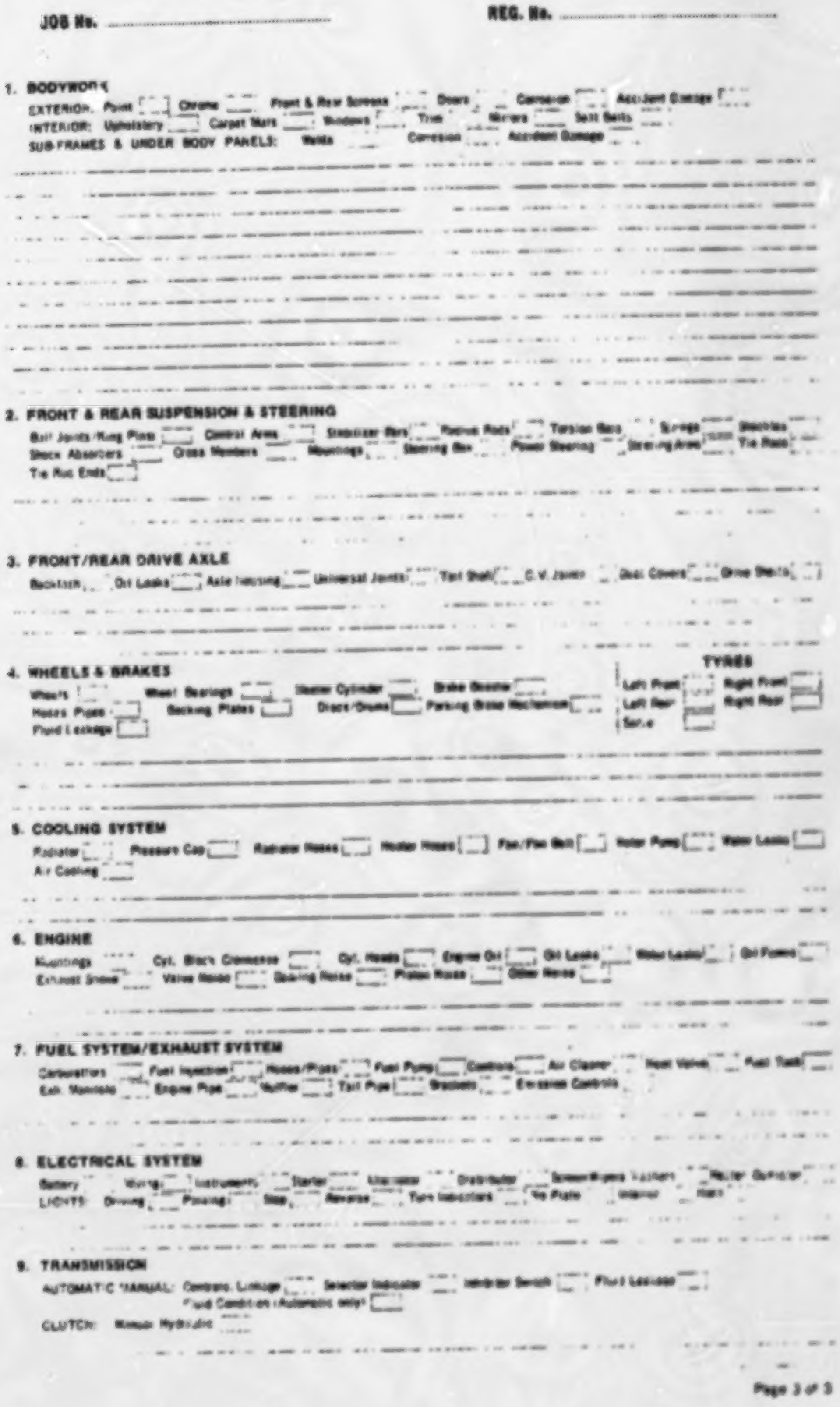
323



JOB No. .... REG. No. ....

1. BODYWORK

EXTERIOR: Paint ☐ Chrome ☐ Front & Rear Screens ☐ Doors ☐ Corrosion ☐ Accident Damage ☐
INTERIOR: Upholstery ☐ Carpet Mats ☐ Windows ☐ Trim ☐ Mirrors ☐ Seat Belts ☐
SUB-FRAMES & UNDER BODY PANELS: Welds ☐ Corrosion ☐ Accident Damage ☐

2. FRONT & REAR SUSPENSION & STEERING

Ball Joints/King Pins ☐ Control Arms ☐ Stabilizer Bars ☐ Radius Rods ☐ Torsion Bars ☐ Springs ☐ Shackles ☐
Shock Absorbers ☐ Cross Members ☐ Mountings ☐ Steering Box ☐ Power Steering ☐ Steering Arms ☐ Tie Rods ☐
Tie Rod Ends ☐

3. FRONT/REAR DRIVE AXLE

Backlash ☐ Oil Leaks ☐ Axle Housing ☐ Universal Joints ☐ Tail Shaft ☐ C.V. Joints ☐ Dust Covers ☐ Drive Shafts ☐

4. WHEELS & BRAKES

Wheels ☐ Wheel Bearings ☐ Master Cylinder ☐ Brake Booster ☐
Hoses Pipes ☐ Backing Plates ☐ Discs/Drums ☐ Parking Brake Mechanism ☐
Fluid Leakage ☐

TYRES

Left Front ☐ Right Front ☐
Left Rear ☐ Right Rear ☐
Spare ☐

5. COOLING SYSTEM

Radiator ☐ Pressure Cap ☐ Radiator Hoses ☐ Heater Hoses ☐ Fan/Fan Belt ☐ Water Pump ☐ Water Leaks ☐
Air Cooling ☐

6. ENGINE

Mountings ☐ Cyl. Block Clearance ☐ Cyl. Heads ☐ Engine Oil ☐ Oil Leaks ☐ Water Leaks ☐ Oil Fumes ☐
Exhaust Smoke ☐ Valve Noise ☐ Bearing Noise ☐ Piston Noise ☐ Other Noise ☐

7. FUEL SYSTEM/EXHAUST SYSTEM

Carburettors ☐ Fuel Injection ☐ Hoses/Pipes ☐ Fuel Pump ☐ Controls ☐ Air Cleaner ☐ Heat Valve ☐ Fuel Tank ☐
Exh. Manifolds ☐ Engine Pipe ☐ Muffler ☐ Tail Pipe ☐ Brackets ☐ Emission Controls ☐

8. ELECTRICAL SYSTEM

Battery ☐ Wiring ☐ Instruments ☐ Starter ☐ Alternator ☐ Distributor ☐ Screen Wipers Washers ☐ Heater Demister ☐
LIGHTS: Driving ☐ Parking ☐ Stop ☐ Reverse ☐ Turn Indicators ☐ No. Plate ☐ Interior ☐ Head ☐

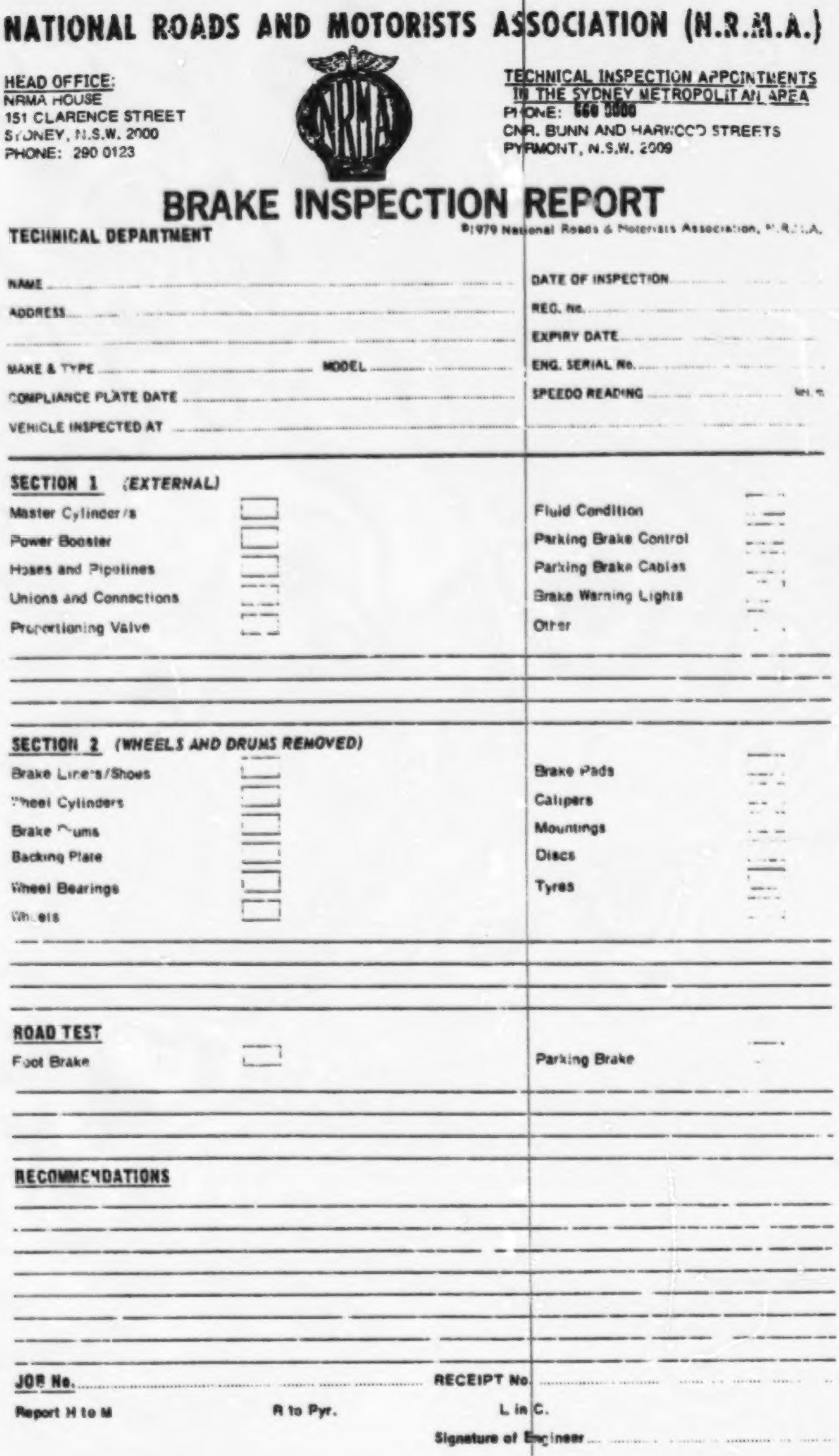
9. TRANSMISSION

AUTOMATIC MANUAL: Controls, Linkage ☐ Selector Indicator ☐ Inhibitor Switch ☐ Fluid Leakage ☐
Fluid Condition (Automatic only) ☐
CLUTCH: Manual Hydraulic ☐

Page 3 of 3

FIGURE E-2. NRMA WARRANTY REPORT CONTINUED

BEST DOCUMENT AVAILABLE



NATIONAL ROADS AND MOTORISTS ASSOCIATION (N.R.M.A.)

HEAD OFFICE:
NRMA HOUSE
151 CLARENCE STREET
SYDNEY, N.S.W. 2000
PHONE: 290 0123

TECHNICAL INSPECTION APPOINTMENTS IN THE SYDNEY METROPOLITAN AREA
PHONE: 660 0000
CNR. BUNN AND HARWOOD STREETS
PYRMONT, N.S.W. 2009

BRAKE INSPECTION REPORT

TECHNICAL DEPARTMENT

©1979 National Roads & Motorists Association, N.R.M.A.

NAME ....
ADDRESS ....
....
MAKE & TYPE .... MODEL ....
COMPLIANCE PLATE DATE ....
VEHICLE INSPECTED AT ....

DATE OF INSPECTION ....
REG. No. ....
EXPIRY DATE ....
ENG. SERIAL No. ....
SPEEDO READING .... km

SECTION 1 *(EXTERNAL)*

- Master Cylinder/s ☐
- Power Booster ☐
- Hoses and Pipelines ☐
- Unions and Connections ☐
- Proportioning Valve ☐
- Fluid Condition ☐
- Parking Brake Control ☐
- Parking Brake Cables ☐
- Brake Warning Lights ☐
- Other ☐

SECTION 2 *(WHEELS AND DRUMS REMOVED)*

- Brake Liners/Shoes ☐
- Wheel Cylinders ☐
- Brake Drums ☐
- Backing Plate ☐
- Wheel Bearings ☐
- Wheels ☐
- Brake Pads ☐
- Calipers ☐
- Mountings ☐
- Discs ☐
- Tyres ☐

ROAD TEST

- Foot Brake ☐
- Parking Brake ☐

RECOMMENDATIONS

JOB No. .... RECEIPT No. ....

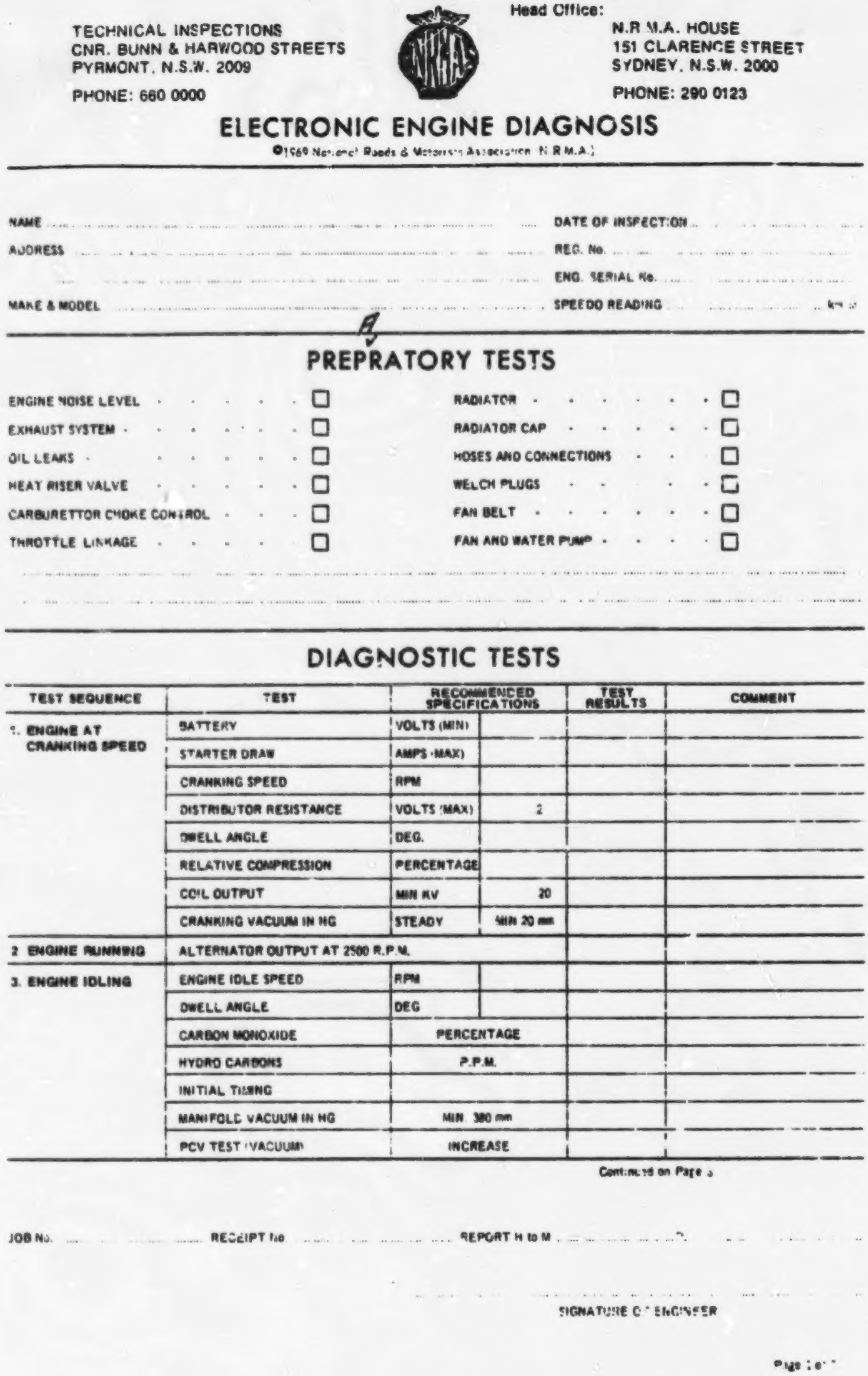
Report H to M R to Pyr. L in C.

Signature of Engineer ....

FIGURE E-3. NRMA BRAKE INSPECTION REPORT

BEST DOCUMENT AVAILABLE

395



TECHNICAL INSPECTIONS
CNR. BUNN & HARWOOD STREETS
PYRMONT, N.S.W. 2009

PHONE: 660 0000

Head Office:
N.R.M.A. HOUSE
151 CLARENCE STREET
SYDNEY, N.S.W. 2000

PHONE: 290 0123

ELECTRONIC ENGINE DIAGNOSIS

©1969 National Roads & Motorists Association (N.R.M.A.)

NAME ....
DATE OF INSPECTION ....
ADDRESS ....
REG. No. ....
....
ENG. SERIAL No. ....
MAKE & MODEL ....
SPEEDO READING .... km

A

PREPRATORY TESTS

ENGINE NOISE LEVEL . . . . . . ☐
EXHAUST SYSTEM . . . . . . ☐
OIL LEAKS . . . . . . ☐
HEAT RISER VALVE . . . . . . ☐
CARBURETTOR CHOKE CONTROL . . . ☐
THROTTLE LINKAGE . . . . . . ☐

RADIATOR . . . . . . ☐
RADIATOR CAP . . . . . . ☐
HOSES AND CONNECTIONS . . . ☐
WELCH PLUGS . . . . . ☐
FAN BELT . . . . . . ☐
FAN AND WATER PUMP . . . . ☐

....
....

DIAGNOSTIC TESTS

TEST SEQUENCE	TEST	RECOMMENCED SPECIFICATIONS		TEST RESULTS	COMMENT
1. ENGINE AT CRANKING SPEED	BATTERY	VOLTS (MIN)			
	STARTER DRAW	AMPS (MAX)			
	CRANKING SPEED	RPM			
	DISTRIBUTOR RESISTANCE	VOLTS (MAX)	2		
	DWELL ANGLE	DEG.			
	RELATIVE COMPRESSION	PERCENTAGE			
	COIL OUTPUT	MIN KV	20		
	CRANKING VACUUM IN HG	STEADY	MIN 20 mm		
2. ENGINE RUNNING	ALTERNATOR OUTPUT AT 2500 R.P.M.				
3. ENGINE IDLING	ENGINE IDLE SPEED	RPM			
	DWELL ANGLE	DEG			
	CARBON MONOXIDE	PERCENTAGE			
	HYDRO CARBONS	P.P.M.			
	INITIAL TIMING				
	MANIFOLD VACUUM IN HG	MIN. 380 mm			
	PCV TEST (VACUUM)	INCREASE			

Continued on Page 2

JOB No. .... RECEIPT No .... REPORT H to M ....

....
SIGNATURE OF ENGINEER

Page 1 of 2

FIGURE E-4. NRMA ENGINE ANALYSIS REPORT

BEST DOCUMENT AVAILABLE

CONDITIONS AND EXPLANATIONS

In the course of an Electronic Engine Diagnosis the internal mechanism of distributors, air cleaners, carburettors and other components are not dismantled for examination, their condition is assessed by performance under testing conditions. This report is issued on the condition that the Association accepts no responsibility for any omission therefrom or mistake therein nor for advice given in respect of the vehicle inspected.

This report is subject to copyright. It is furnished to the member on the clear understanding that its contents are private and confidential.

If you require any further information regards the inspection please phone.

Sydney - - - - -	660 0000
Canberra - - - - -	49 6666
Newcastle - - - - -	24 621
Wollongong - - - - -	29 8133

quoting the job No.

If you are pleased with this report would you please inform your friends and fellow motorists of this service to members.

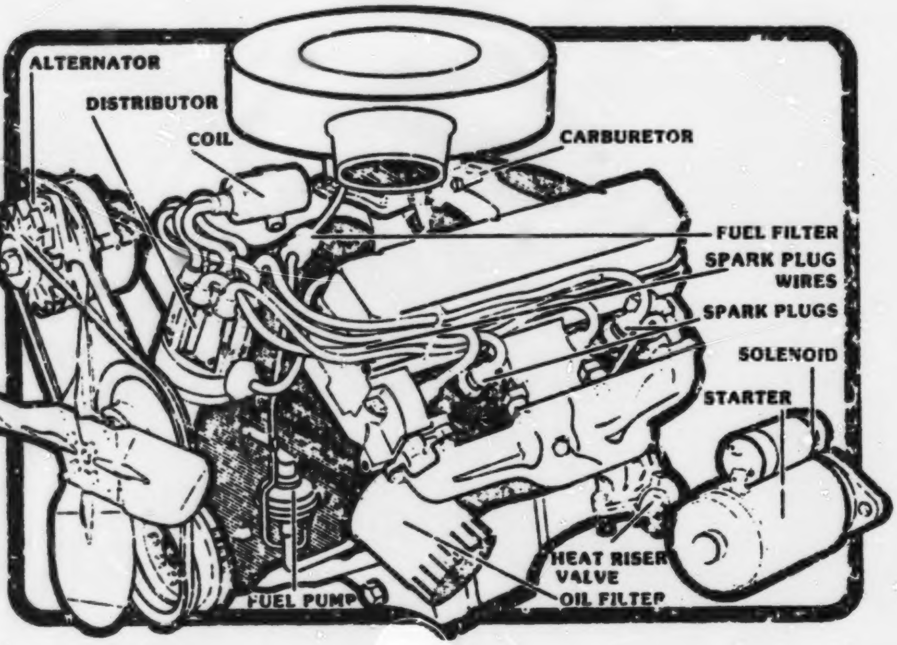

ALTERNATOR
DISTRIBUTOR
COIL
CARBURETOR
FUEL FILTER
SPARK PLUG WIRES
SPARK PLUGS
SOLENOID
STARTER
HEAT RISER VALVE
OIL FILTER
FUEL PUMP

FIGURE E-4. NRMA ENGINE ANALYSIS REPORT CONTINUED

BEST DOCUMENT AVAILABLE

DIAGNOSTIC TESTS (contd.)

TEST SEQUENCE	TEST	RECOMMEND SPECIFICATIONS		TEST RESULT	COMMENT
4. ENGINE SET AT 1500 RPM	CARBON MONOXIDE	PERCENTAGE			
	HYDROCARBON	P.P.M.			
	IGN. SECONDARY TEST 1	2 to 6 KV			
	TEST 2	MIN KV 20			
OSCILLOSCOPE READINGS	COIL POLARITY	VISUAL			
	FIRING LINE	MAX. KV VARIATION	3		
	SECONDARY INSULATION	VISUAL			
	SECONDARY RESISTANCE	VISUAL			
	COIL & CONDENSOR CONDITION	VISUAL			
	CONTACT POINT CONDITION	VISUAL			
	CAM LOBE ACCURACY	VISUAL			
	ALTERNATOR CONDITION	VISUAL			
	MANIFOLD VACUUM IN HG	MINIMUM	380 MM		
5. POWER BALANCE AT 1500 RPM	CYLINDER R.P.M. CHANGE		MAX. R.P.M. VARIATION		
	1 2 3 4 5 6 7 9				
			▨	▨	
6. SNAP ACCELERATION 2500 RPM	CARBON MONOXIDE PERCENTAGE				
	SPARK PLUG KV		UNIFORM KV INCREASE		
	1 2 3 4 5 6 7 8				
			▨	▨	
7. ENGINE SET AT 2500 RPM	DWELL	DEG			
	DWELL VARIATION	DEG (MAX)	3.5		
	TIMING ADVANCE	DEG			
	INITIAL & ADVANCE	DEG			
	CARBON MONOXIDE	PERCENTAGE			
	HYDROCARBON	P.P.M.			
	CHARGING VOLTS				
	MANIFOLD VACUUM HG	MINIMUM 540 MM			

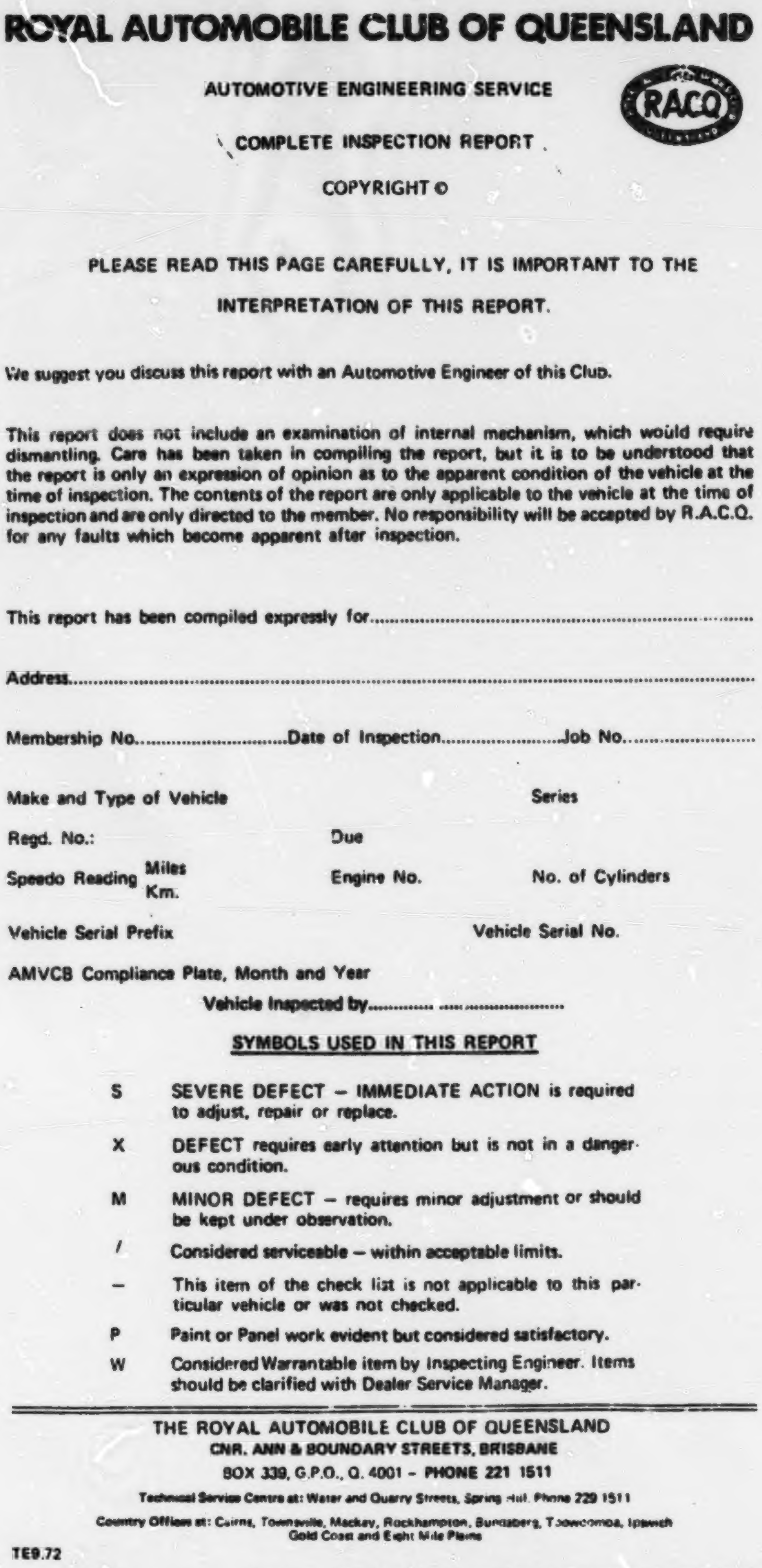
RECOMMENDATIONS

SUMMARY

[illegible] 38A - 11/77

FIGURE E-4. NRMA ENGINE ANALYSIS REPORT CONTINUED

BEST DOCUMENT AVAILABLE



ROYAL AUTOMOBILE CLUB OF QUEENSLAND

AUTOMOTIVE ENGINEERING SERVICE

COMPLETE INSPECTION REPORT

COPYRIGHT ©

PLEASE READ THIS PAGE CAREFULLY, IT IS IMPORTANT TO THE INTERPRETATION OF THIS REPORT.

We suggest you discuss this report with an Automotive Engineer of this Club.

This report does not include an examination of internal mechanism, which would require dismantling. Care has been taken in compiling the report, but it is to be understood that the report is only an expression of opinion as to the apparent condition of the vehicle at the time of inspection. The contents of the report are only applicable to the vehicle at the time of inspection and are only directed to the member. No responsibility will be accepted by R.A.C.Q. for any faults which become apparent after inspection.

This report has been compiled expressly for..

Address..

Membership No............................Date of Inspection......................Job No.........................

Make and Type of Vehicle Series

Regd. No.: Due

Speedo Reading Miles Km. Engine No. No. of Cylinders

Vehicle Serial Prefix Vehicle Serial No.

AMVCB Compliance Plate, Month and Year

Vehicle Inspected by.......................................

SYMBOLS USED IN THIS REPORT

S	SEVERE DEFECT – IMMEDIATE ACTION is required to adjust, repair or replace.
X	DEFECT requires early attention but is not in a dangerous condition.
M	MINOR DEFECT – requires minor adjustment or should be kept under observation.
/	Considered serviceable – within acceptable limits.
–	This item of the check list is not applicable to this particular vehicle or was not checked.
P	Paint or Panel work evident but considered satisfactory.
W	Considered Warrantable item by Inspecting Engineer. Items should be clarified with Dealer Service Manager.

THE ROYAL AUTOMOBILE CLUB OF QUEENSLAND
CNR. ANN & BOUNDARY STREETS, BRISBANE
BOX 339, G.P.O., Q. 4001 – PHONE 221 1511

Technical Service Centre at: Water and Quarry Streets, Spring Hill. Phone 229 1511

Country Offices at: Cairns, Townsville, Mackay, Rockhampton, Bundaberg, Toowoomba, Ipswich
Gold Coast and Eight Mile Plains

TE9.72

FIGURE E-5. RACQ COMPLETE INSPECTION REPORT

BEST DOCUMENT AVAILABLE

CHECK FRONT PAGE SYMBOL EXPLANATION BEFORE READING THIS REPORT

BODYWORK

Body Panels .... Doors/Hood/Boot .... Window gear .... Seats ....
Seat Belts .... Locks/Security .... Paint .... Brightwork .... Interior trims .... Glass .... Rear view mirror/s .... Extras .... Corrosion ....

FRAME AND UNDERBODY

Sub frames .... Cross members .... Bolts/Rivets/Welds .... Floor panels ....
Exhaust System............ Corrosion.........................

SUSPENSION

Front: Springs .... Control arms .... Radius rods .... Stabiliser bars ....
Shock absorbers........... Bearings .... Seals .... Other Suspension Units ....
Rear: Springs .... Shackles/U bolts .... Radius rods .... Shock Absorbers ....

STEERING

Box and Column .... Tie rods/joints .... Ball joints .... King Pins ....

STEERING ALIGNMENT SETTINGS – At Kerb Weight (as applicable)

	Toe-in	Camber		King Pin Inclination		Caster		Toe out on turns Inner wheel at		Tyre Pull Meters/Km	
		L/R	R/S	L/S	R/S	L/S	R/S	L/S	R/S	L/S L.R.	R/S L.R.
Actual	....	....		....		....		....		....	

TYRES

Front: Left .... Right ....
Rear: Left .... Right ....
Spare ....
Cuts/fractures/etc. ....

WHEELS/NUTS/STUDS/CRACKS

Front: Left .... Right ....
Rear: Left .... Right ....

BRAKES – VISUAL

Master Cylinder .... Wheel cylinders F .... R .... Hoses/Pipes ....
Booster .... Drums F .... R .... Linings F .... R............
Discs F .... R .... Hand Brake ....

TRANSMISSION – VISUAL

Gearbox: Manual .... Automatic .... Oil leaks ....
Driveline: Shaft/s .... Joints ....
Rear Assembly: Bearings .... Housing .... Oil leaks
Clutch: Mechanical .... Hydraulic .... Pedal Free Travel ....

OIL LEVELS

Engine .... Gearbox .... Differential .... Hydraulics: Brake ....
Clutch .... Greasing Points ....

FIGURE E-5. RACQ COMPLETE INSPECTION REPORT CONTINUED

BEST DOCUMENT AVAILABLE

DISCUSS THIS REPORT WITH A CLUB ENGINEER

ENGINE

Cylinder Comparison Test .... Valve Noise .... Piston Noise .... Bearing Noise ....

Other Noises .... Mountings .... Water Leaks .... Oil Leaks .... Oil Fumes ....

Exhaust Smoke .... P.C.V. Valve .... Emission Control Units ....

FUEL SYSTEM

Carburation/Fuel Injection............ Tank/Hoses/Pipes............ Pump............Manifold Valve............

Controls............ Air filter............ Choke Man/Auto............ C.O.%............

COOLING SYSTEM

Radiator Core/Tanks .... Water Level/Condition .... Pressure Cap .... Hoses ....

Fan .... Belt .... Water Pump............ Air Cooling .... Temp Gauge/Light ....

ELECTRICAL

Battery .... Leads .... Clamp ....

Generator/Alternator............Control Unit............

Ignition: Distributor .... Leads Low/High Tension .... Spark Plugs .... Timing ....

Lights: Driving Beam .... Dip Beam .... Park .... Rear .... Stop Lights ....

Licence Plate .... Flashing Lights .... Dash Indicators .... Interior ....

Head Light Alignment .... Starter Motor ....

Accessories: Radio .... Tape Player .... Heater/Demister .... Air Conditioning ....

Horn .... Windscreen Wipers .... Washers .... Other Instruments ....

Switches/Controls ....

SPEEDOMETER (Water Street and Eight Mile Plains)

Actual Km/h	40	60	80	100
Speedo Indicated Km/h – M.P.H.	....	....	....	....

ROAD TEST

Engine Performance: .... Idle ....

Transmission Units: Noise Level .... Gearbox Operation .... Clutch Action ....

Steering: Stability ....

Vehicle: Suspension............... Body Noises...............

Braking Efficiency .... Hand Brake Efficiency ....

ADDITIONAL REMARKS

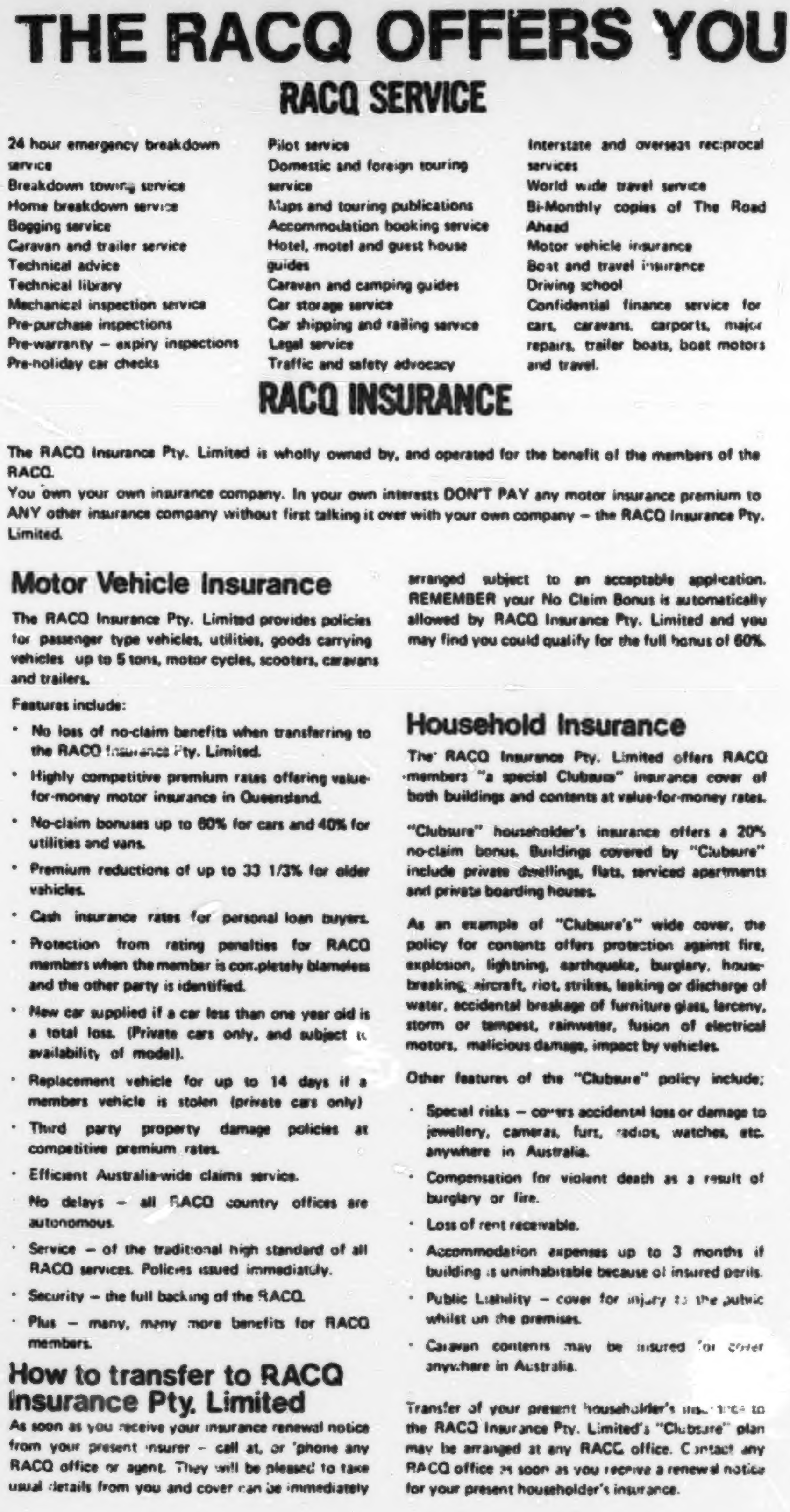
IMMEDIATE REPAIRS RECOMMENDED

SUMMARY

FIGURE E-5. RACQ COMPLETE INSPECTION REPORT CONTINUED

[redacted]

BEST DOCUMENT AVAILABLE



THE RACQ OFFERS YOU

RACQ SERVICE

- 24 hour emergency breakdown service
- Breakdown towing service
- Home breakdown service
- Bogging service
- Caravan and trailer service
- Technical advice
- Technical library
- Mechanical inspection service
- Pre-purchase inspections
- Pre-warranty – expiry inspections
- Pre-holiday car checks
- Pilot service
- Domestic and foreign touring service
- Maps and touring publications
- Accommodation booking service
- Hotel, motel and guest house guides
- Caravan and camping guides
- Car storage service
- Car shipping and railing service
- Legal service
- Traffic and safety advocacy
- Interstate and overseas reciprocal services
- World wide travel service
- Bi-Monthly copies of The Road Ahead
- Motor vehicle insurance
- Boat and travel insurance
- Driving school
- Confidential finance service for cars, caravans, carports, major repairs, trailer boats, boat motors and travel.

RACQ INSURANCE

The RACQ Insurance Pty. Limited is wholly owned by, and operated for the benefit of the members of the RACQ.

You own your own insurance company. In your own interests DON'T PAY any motor insurance premium to ANY other insurance company without first talking it over with your own company – the RACQ Insurance Pty. Limited.

Motor Vehicle Insurance

The RACQ Insurance Pty. Limited provides policies for passenger type vehicles, utilities, goods carrying vehicles up to 5 tons, motor cycles, scooters, caravans and trailers.

Features include:

- No loss of no-claim benefits when transferring to the RACQ Insurance Pty. Limited.
- Highly competitive premium rates offering value-for-money motor insurance in Queensland.
- No-claim bonuses up to 60% for cars and 40% for utilities and vans.
- Premium reductions of up to 33 1/3% for older vehicles.
- Cash insurance rates for personal loan buyers.
- Protection from rating penalties for RACQ members when the member is completely blameless and the other party is identified.
- New car supplied if a car less than one year old is a total loss. (Private cars only, and subject to availability of model).
- Replacement vehicle for up to 14 days if a members vehicle is stolen (private cars only)
- Third party property damage policies at competitive premium rates.
- Efficient Australia-wide claims service.
- No delays – all RACQ country offices are autonomous.
- Service – of the traditional high standard of all RACQ services. Policies issued immediately.
- Security – the full backing of the RACQ.
- Plus – many, many more benefits for RACQ members.

How to transfer to RACQ Insurance Pty. Limited

As soon as you receive your insurance renewal notice from your present insurer – call at, or 'phone any RACQ office or agent. They will be pleased to take usual details from you and cover can be immediately arranged subject to an acceptable application. REMEMBER your No Claim Bonus is automatically allowed by RACQ Insurance Pty. Limited and you may find you could qualify for the full bonus of 60%.

Household Insurance

The RACQ Insurance Pty. Limited offers RACQ members "a special Clubsure" insurance cover of both buildings and contents at value-for-money rates.

"Clubsure" householder's insurance offers a 20% no-claim bonus. Buildings covered by "Clubsure" include private dwellings, flats, serviced apartments and private boarding houses.

As an example of "Clubsure's" wide cover, the policy for contents offers protection against fire, explosion, lightning, earthquake, burglary, housebreaking, aircraft, riot, strikes, leaking or discharge of water, accidental breakage of furniture glass, larceny, storm or tempest, rainwater, fusion of electrical motors, malicious damage, impact by vehicles.

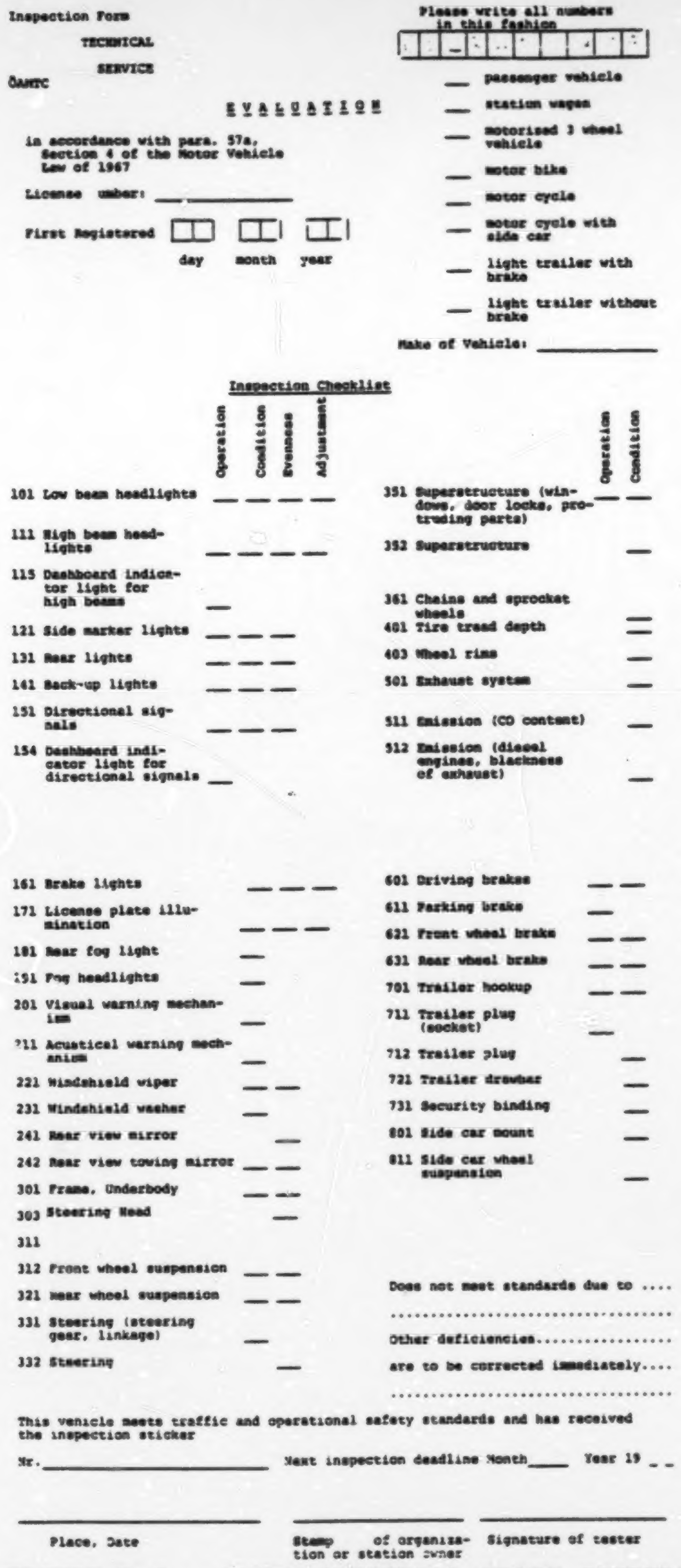
Other features of the "Clubsure" policy include;

- Special risks – covers accidental loss or damage to jewellery, cameras, furs, radios, watches, etc. anywhere in Australia.
- Compensation for violent death as a result of burglary or fire.
- Loss of rent receivable.
- Accommodation expenses up to 3 months if building is uninhabitable because of insured perils.
- Public Liability – cover for injury to the public whilst on the premises.
- Caravan contents may be insured for cover anywhere in Australia.

Transfer of your present householder's insurance to the RACQ Insurance Pty. Limited's "Clubsure" plan may be arranged at any RACQ office. Contact any RACQ office as soon as you receive a renewal notice for your present householder's insurance.

FIGURE E-6. RACQ LIST OF SERVICES

BEST DOCUMENT AVAILABLE



Inspection Form

TECHNICAL

SERVICE

ÖAMTC

EVALUATION

in accordance with para. 57a,
Section 4 of the Motor Vehicle
Law of 1967

License umber: ______________

First Registered ☐☐ day ☐☐ month ☐☐ year

Please write all numbers
in this fashion

___ passenger vehicle

___ station wagon

___ motorised 3 wheel vehicle

___ motor bike

___ motor cycle

___ motor cycle with side car

___ light trailer with brake

___ light trailer without brake

Make of Vehicle: ______________

Inspection Checklist

	Operation	Condition	Evenness	Adjustment
101 Low beam headlights	___	___	___	___
111 High beam headlights	___	___	___	___
115 Dashboard indicator light for high beams	___			
121 Side marker lights	___	___	___	
131 Rear lights	___	___	___	
141 Back-up lights	___	___	___	
151 Directional signals	___	___	___	
154 Dashboard indicator light for directional signals	___			
161 Brake lights	___	___	___	
171 License plate illumination	___	___	___	
181 Rear fog light	___			
191 Fog headlights	___			
201 Visual warning mechanism	___			
211 Acustical warning mechanism	___			
221 Windshield wiper	___	___		
231 Windshield washer	___			
241 Rear view mirror		___		
242 Rear view towing mirror	___	___		
301 Frame, Underbody	___	___		
303 Steering Head		___		
311				
312 Front wheel suspension	___	___		
321 Rear wheel suspension	___	___		
331 Steering (steering gear, linkage)	___			
332 Steering		___		

	Operation	Condition
351 Superstructure (windows, door locks, protruding parts)	___	___
352 Superstructure		___
361 Chains and sprocket wheels		___
401 Tire tread depth		___
403 Wheel rims		___
501 Exhaust system		___
511 Emission (CO content)		___
512 Emission (diesel engines, blackness of exhaust)		___
601 Driving brakes	___	___
611 Parking brake	___	
621 Front wheel brake	___	___
631 Rear wheel brake	___	___
701 Trailer hookup	___	___
711 Trailer plug (socket)	___	
712 Trailer plug		___
721 Trailer drawbar		___
731 Security binding		___
801 Side car mount		___
811 Side car wheel suspension		___

Does not meet standards due to ....
....
Other deficiencies..................
are to be corrected immediately....
....

This vehicle meets traffic and operational safety standards and has received the inspection sticker

Mr.______________________ Next inspection deadline Month____ Year 19 _ _

Place, Date ______________________

Stamp of organization or station owner ______________________

Signature of tester ______________________

FIGURE E-7. OAMTC (AUSTRIA) STATE COMPULSORY INSPECTION CHECKLIST

BEST DOCUMENT AVAILABLE

Type of Vehicle: .... Make, Model: .... First Registration: .... ☐ C
License Number: .... Chassis/Motor Number, if plates temporary: ....
Speedometer Reading: .... Registered to: .... ☐ P
....

1. Steering gear and steering linkage play ☐
2. Wheel bearing play, operation ☐
3. Wheel suspension and springs, front r-l ☐
4. Wheel suspension and springs, rear r-l ☐
5. Shock absorber operation ☐
6. Shock absorber mounting, leaks, front r-l/ rear r-l ☐
7. Stabilizers ☐
8. Engine and transmission mounts ☐
9. Drive line and joints ☐
10. Frame and underbody: deformities, rust ☐
11. Exhaust pipe, muffler, hanger ☐
12. Transmission and differential, oil leakage ☐
13. Brake hoses, lines (abrasion, leaks, rust) ☐
14. Tire tread depth, front r-l/ rear r-l ☐
15. Tire wear abnormal, front r-l/rear r-l ☐
16. Tire walls, run out, wheel rim, front r-l ☐
17. Tire walls, run out, wheel rim, rear r-l ☐
18. Brake pedal: distance, pressure ☐
19. Brakes: operation, front r-l/ rear r-l ☐
20. Parking brake: operation r-l ☐
21. Brake fluid ☐
22. Headlights: operation, condition r-l ☐
23. Headlight adjustment, low beams ☐
24. Side marker lights: operation, condition, front r-l ☐
25. Rear lights: operation r-l ☐
26. Backup lights: r-l ☐
27. Directional signals: operation front r-l/ rear r-l ☐
28. Brakelights: operation, condition, r-l ☐
29. Additional lighting: operation, condition, controls ☐
30. Additional lighting: attachment, adjustment ☐
31. License plate illuminator: operation condition ☐
32. Dashboard indicator lights: operation, directional signals, highbeams ☐
33. Warning device: optical, acustical ☐
34. Windshield wipers: operation condition ☐
35. Windshield washer: operation ☐

36. Rear view mirror: outside, inside ☐
37. Battery: wear, maintenance ☐
38. Battery: shock stress, mounting ☐
39. Starter: operation, mounting, noise ☐
40. Generator: operation, mounting, noise ☐
41. Drive belt: condition, tension ☐
42. Cooling system: radiator, pump, hoses ☐
43. Compression test ☐
44. Engine noises ☐
45. Engine: oil level, oil leaks ☐
46. Flanges, bend: tightness ☐
47. Air filter mounting ☐
48. Emissions test ☐
49. Exhaust:noticeable color, blue-black ☐
50. Shifting, synchronization, linkage ☐
51. Clutch: slippage, release, play ☐
52. Clutch engagement (mechanical/ hydraulic ☐
53. Acceleration...m/sec^2, or ....sec 60 - 100 km/h ☐
54. Transmission and differential noises ☐
55. Chassis or body noises ☐
56. Forward motion steering vibration ☐
57. Signs of deterioration ☐
58. Seatbelts: mounting, condition ☐
59. Superstructure: safe according to para. 57a of Motor Vehicle Law ☐
60. Breakdown warning equipment, first aid kit ☐
61. Evidence of previous body damage (body work, repainting) ☐
62. Other: ☐

Test results discussed yes no

This vehicle meets the requirements of the Motor Vehicle Law, para. 57a (pertinent squares enclosed in darker lines) yes no

....

Place, Date Stamp Signature

FIGURE E-8. OAMTC (AUSTRIA) COMPREHENSIVE INSPECTION CHECKLIST

[redacted]

BEST DOCUMENT AVAILABLE

A D A C

Technical Inspection Service -- Engine Test

Record of Test Results

ADAC Central Office, Baumgartnerstrasse 53, 8000 Munich 70, Tel. (089) 7676-1

Dear ADAC Member,

You have entrusted you car to the ADAC Street Patrol, which has checked it out very carefully. Experienced mechanics using the most up to date measureing instruments have inspected the engine of your vehicle, and the results have been set down in the test record booklet.

Accompanying each measurement is a brief explanation of its significance and the possible defects.

The ADAC engine test examines carefully the functioning of the engine and the igrition system. The performance test which follows--the test measures engine performance at the driving axle--provides an indication of the momentary condition of the engine, as does the operational portion of the test. The results, however, can give no indication of how the engine and its parts will perform in the future nor how long they can be expected to last.

FIGURE E-9. ADAC (GERMANY) EXPLANATION
OF ENGINE TEST

Vehicle Type .... License Plate Number ....

Name .... Mileage Reading ....

Measurement	G	S	R		Defects and Causes
1. Distributor Resistance				Remarks:	Electrical resistance too high on connections between battery, ignition coil and distributor, due to effects of corrosion. As a result, voltage in ignition coil is too low and firing, poor.
2. Mechanical Functioning of Distributor				Remarks:	Wear or defects on distributor parts causes an uncontrollable change in dwell angle (interrupter point gap) and, thus, in timing.
3. Interrupter Functioning				Remarks:	Burned out or worn out interrupter contacts. Possible causes: weakening of spring tension or broken spring. Leads to misfiring and starting difficulties.
4. Interrupter Point Gap (Dwell Angle)				Remarks:	Incorrect dwell angle as a result of wear, slippage of contact points or wrong setting. Leads to imporper firing and inaccurate timing.
5. Timing				Remarks:	Premature or late firing can result in poor engine performance, difficult starting, higher fuel consumption and mechanical and thermal strain on the engine (eg. pinging).
6. Centrifugal Advance				Remarks:	As engine rpm's increase, the firing advances automatically. When spring tension of the centrifugal weights is off, spring broken or weights rusted, proper advance is no longer possible (same problems as in #5).

Explanation of Symbols: G = good, S = have checked at next inspection, R = repair as soon as possible.

FIGURE E-9. ADAC ENGINE TEST RESULTS

Measurement	G	S	R	Remarks	Defects and Causes
7. Vacuum Advance				Remarks:	No automatic timing advance (as in #6) when diaphragm frozen or vacuum chamber leaky. Vacuum line may also be leaky or stopped up at carburetor.
8. Available Ignition Voltage					Too little when battery weak (defective), ignition coil bad or resistance in distributor high (see also #1). Possibly excessive current input to starter.
a. when starting				Remarks:	
b. at idle				Remarks:	Influenced by incorrect spark plug gap, damaged ignition coil, distributor cap or spark cables. Also affected by high distributor resistance.
c. under strain				Remarks:	Drop in performance indicates dirty spark plugs, falsely connected spark cables or incorrect distributor setting. Misfirings at high rpm's.
9. Ignition Coil Functioning				Remarks:	Defective coil can result in misfirings and drop in performance from inadequate voltage.
10. Ignition Coil Polarity				Remarks:	Reversed polarity causes increased wear to spark plugs and low ignition performance. Misfirings, poor performance and starting problems are the results. Always due to oversight at assembly plant.
11. Condenser				Remarks:	Defective condenser causes rapid interrupter point wear and high burn out (see also #3).
12. Resistance in Cables				Remarks:	Excessive resistance (can be recognized by disturbed radio reception, transmission or break in cable) leads to starting problems and misfiring under strain.

Explanation of Symbols: G = good, S = have checked at next inspection, R = repair as soon as possible.

FIGURE E-9. ADAC ENGINE TEST RESULTS CONTINUED

Measurement	G	S	R	Defects and Causes
13. Battery Charge				Under strain battery voltage should not drop below 3.5 volts for 6 volt batteries or 7 volts for 12 volt batteries. Greater drop in voltage indicates dead battery or defective plates.
	Remarks:			
	....			
14. Generator Voltage				Correct charge: 7 volts or 14 volts, as appropriate. Large deviations cause heavy strain on battery. Regulator also may be defective.
	Remarks:			
	....			

15. PERFORMANCE MEASUREMENT:

Performance measured at driving axle ....KW at.................rpm
(1 KW ~ 1.36 hp)

Remarks: ....

....

The official German Industrial Standard (DIN) performance reading for an engine, which is entered in the Motor Vehicle Registration Certificate, is taken at the crankshaft. The ADAC takes its reading from the driving axle. Lying between the two, however, are transmission, universal drive shaft, rear axle drive and tires, all of which cause a reduction in measured performance. On the average, the expected negative deviation from the German Industrial Standard reading amounts to about 30% on cars with manual transmissions and about 40% on cars with automatic transmissions.

Explanation of Symbols: G = good, S = have checked at next inspection, R = repair as soon as possible.

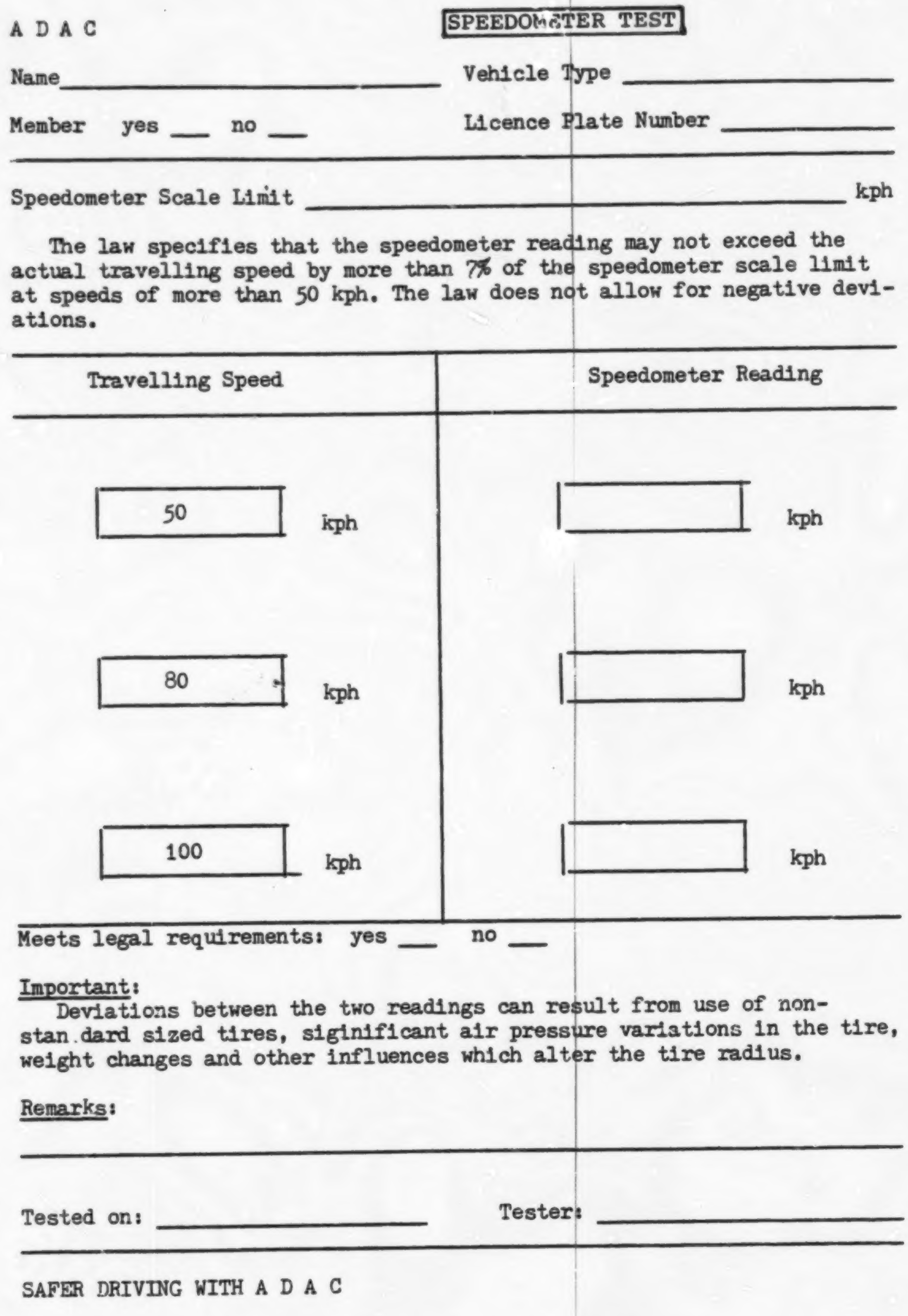
Inspection Scheduled for .... Tester ....

Please arrive at the testing station at the appointed time, as otherwise smooth processing of vehicles at the station may be upset and you might not be able to be admitted to the test. Before the test you should have the engine of your vehicle cleaned, if it is dirty; otherwise, it may be difficult to take the measurements. Also check the water level in the radiator and the oil level of the engine before arriving for the test. Once on the platform, your car will be driven for performance.

For technical reasons it is not possible to inspect diesel engine vehicles.

Please bring this test record booklet and your membership card with you to the testing station.

FIGURE E-9. ADAC ENGINE TEST RESULTS CONTINUED



A D A C

SPEEDOMETER TEST

Name ____________________ Vehicle Type ____________

Member yes ___ no ___ Licence Plate Number ____________

Speedometer Scale Limit ____________________ kph

The law specifies that the speedometer reading may not exceed the actual travelling speed by more than 7% of the speedometer scale limit at speeds of more than 50 kph. The law does not allow for negative deviations.

Travelling Speed	Speedometer Reading
50 kph	☐ kph
80 kph	☐ kph
100 kph	☐ kph

Meets legal requirements: yes ___ no ___

Important:
Deviations between the two readings can result from use of non-standard sized tires, siginificant air pressure variations in the tire, weight changes and other influences which alter the tire radius.

Remarks:

Tested on: ____________ Tester: ____________

SAFER DRIVING WITH A D A C

FIGURE E-10. ADAC SPEEDOMETER TEST

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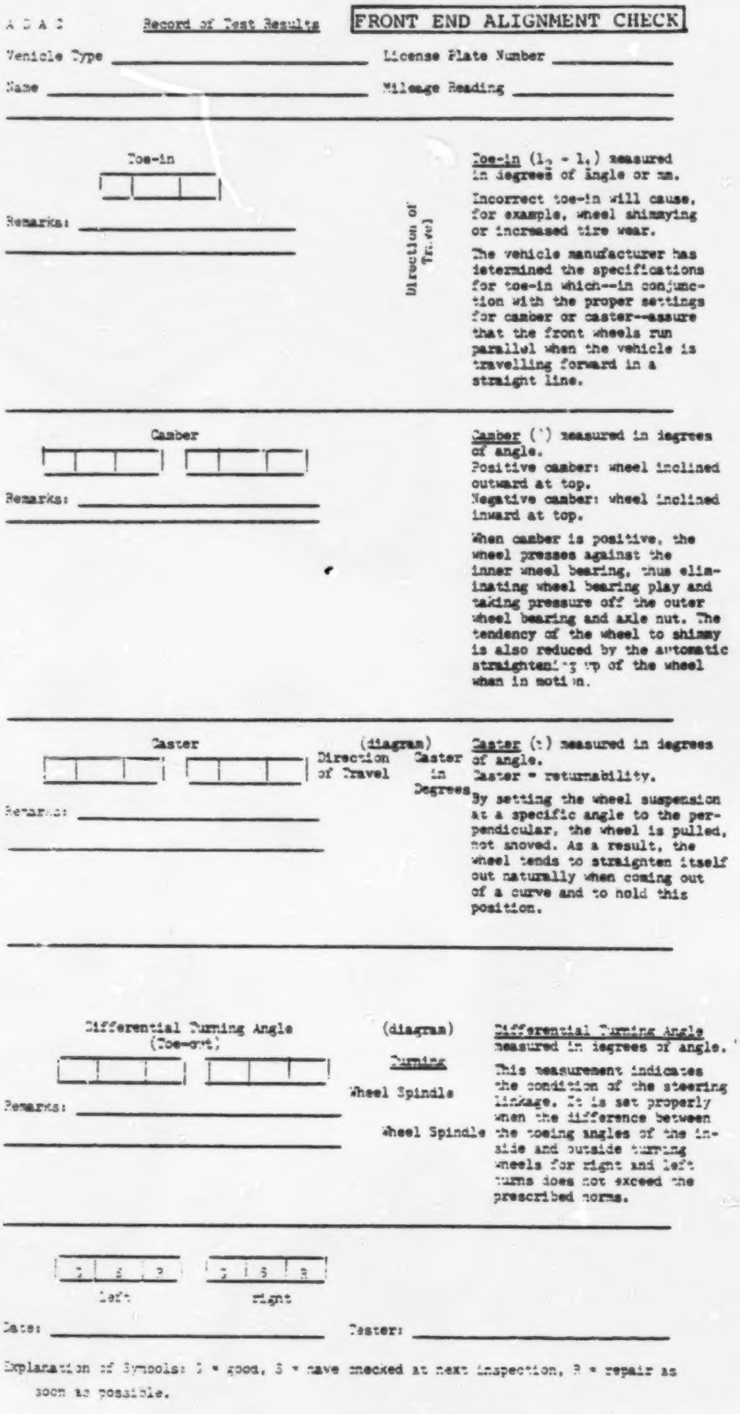

A D A C   Record of Test Results   **FRONT END ALIGNMENT CHECK**

Vehicle Type ____________________ License Plate Number __________

Name ____________________ Mileage Reading __________

Toe-in

☐☐☐

Remarks: ____________________

____

Direction of Travel

Toe-in $(l_2 - l_1)$ measured in degrees of angle or mm.

Incorrect toe-in will cause, for example, wheel shimmying or increased tire wear.

The vehicle manufacturer has determined the specifications for toe-in which--in conjunction with the proper settings for camber or caster--assure that the front wheels run parallel when the vehicle is travelling forward in a straight line.

Camber

☐☐☐ ☐☐☐

Remarks: ____________________

____

Camber (°) measured in degrees of angle.
Positive camber: wheel inclined outward at top.
Negative camber: wheel inclined inward at top.

When camber is positive, the wheel presses against the inner wheel bearing, thus eliminating wheel bearing play and taking pressure off the outer wheel bearing and axle nut. The tendency of the wheel to shimmy is also reduced by the automatic straightening up of the wheel when in motion.

Caster

☐☐☐ ☐☐☐

Remarks: ____________________

____

(diagram)

Caster (°) measured in degrees of angle.
Caster = returnability.

By setting the wheel suspension at a specific angle to the perpendicular, the wheel is pulled, not shoved. As a result, the wheel tends to straighten itself out naturally when coming out of a curve and to hold this position.

Differential Turning Angle
(Toe-out)

☐☐☐ ☐☐☐

Remarks: ____________________

____

(diagram)

Differential Turning Angle measured in degrees of angle.

This measurement indicates the condition of the steering linkage. It is set properly when the difference between the toeing angles of the inside and outside turning wheels for right and left turns does not exceed the prescribed norms.

G	S	R

Left

G	S	R

Right

Date: ____________________ Tester: ____________________

Explanation of Symbols: G = good, S = have checked at next inspection, R = repair as soon as possible.

FIGURE E-11. ADAC FRONT END ALIGNMENT CHECKLIST

ADAC

BRAKE TEST

Last name ____________ First name ____________

Zip Code ____________ City of Residence ____________

Street ____________

Vehicle Type ____________ License Number ____________

Member: yes/no

Weight of Vehicle at time of testing: ____________ kg

Brake Pedal Pressure: _____N

left front	_____N	Handbrake	_____N	right front
	_____N	Footbrake	_____N	

Remarks: ____________

left rear	_____N	Handbrake	_____N	right rear
	_____N	Footbrake	_____N	

Brake Pedal Pressure: _____N

1 newton = force required to accelerate a mass of one kilogram one meter per second per second.

Weather conditions at time of testing: dry/wet

Evaluation:	Sound	Deficient
Brake Pedal Pressure	___	___
Brake Pedal Distance	___	___
Evenness of Braking	___	___
Level of Braking Power	___	___
Functinning of handbrake	___	___
Play in handbrake	___	___

Attention: This test evaluates the operational effectiveness of the braking system at a particular moment in time. The test, therefore, can give no indication of the condition of the brake lining itself. Only in a repair shop is it possible to determine the actual thickness of the brake lining and to check for mechanical deficiencies or rusted out brake lines. If irregularities in the functioning of your brakes have been discovered, the ADAC recommends, in the interest of your own safety, that you have your vehicle checked out at your local repair shop.

Tested on: ____________

Tester: ____________

FIGURE E-12. ADAC BRAKE TEST CHECKLIST

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A D A C

LIGHTING TEST

Name ______________________________

Vehicle Type ____________________ Model Year ____________

Operational Deficiencies:	Left		Right	Dashboard Indicator Light
1. High Beams	___		___	___
2. Low Beams	___		___	
3. Parking Lights	___		___	
4. Driving Lights	___		___	
5. Fog Headlights	___		___	
6. Rear Lights	___		___	
7. Brake Lights	___		___	
8. Directional Signals	___		___	___
9. Warning Flasher		___		___
10. License Plate Illuminator		___		
11. Rear Fog Light		___		___
12. Back-up Lights		___		
13. Roadside Parking Lights	___		___	
Other Deficiencies:				
14. Lightbulb improperly installed	___		___	
15. Reflector defective/corroded	___		___	
16. Adjustment screw frozen (headlight adjustment could not be corrected)	___		___	
17. Deflector plate/cover glass defective/faded	___		___	
18. Lighting system fails to meet legal requirements		___		
19. Other		___		

Remarks:

____
Date:

____
Stamp and Signature

FIGURE E-13. ADAC LIGHTING TEST CHECKLIST

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BEST DOCUMENT AVAILABLE

ADAC

SHOCK ABSORBER TEST

Name ____________________

Vehicle Type ____________________

Member yes ___ no ___

Model Year ____________________

Safety Threshholds for Front Axle

___ mm to ___ mm

Test Measurement ________ mm

Condition: ___ good

___ satisfactory

___ poor

Test Measurement ________ mm

Condition: ___ good

___ satisfactory

___ poor

Test Measurement ________ mm

Condition: ___ good

___ satisfactory

___ poor

Test Measurement ________ mm

Condition: ___ good

___ satisfactory

___ poor

Safety Threshholds for Rear Axle

Remarks:

If the measurement results fall within the threshhold limits, the shock absorbers are performing satisfactorily. Measurements which approach the lower limit indicate optimal performance; higher measurements, poor performance. A rating of satisfactory does not necessarily mean that the shock absorbers must be replaced immediately. Only when the measurement falls within the upper half of the threshhold limits is it reasonable to suspect a significant drop in performance which can adversely affect handling stability--especially when making turns and braking. For reasons of traffic safety, shock absorbers should be replaced if they demonstrate a reduction in performance of more than 50%, that is, if the performance measurement exceeds the threshhold limit; and they should be replaced in pairs. Replacement of shock absorbers is also recommended when the test shows a rather large divergence between the performance levels of the shock absorbers on the same axle. However, before replacing shock absorbers, the suspension system definitely should be checked out to determine whether all parts are functioning properly, as wear or defects here can in some cases simulate the conditions caused by poor shock absorbers.

Date: ____________________ Tester: ____________________

FIGURE E-14. ADAC SHOCK ABSORBER TEST CHECKLIST

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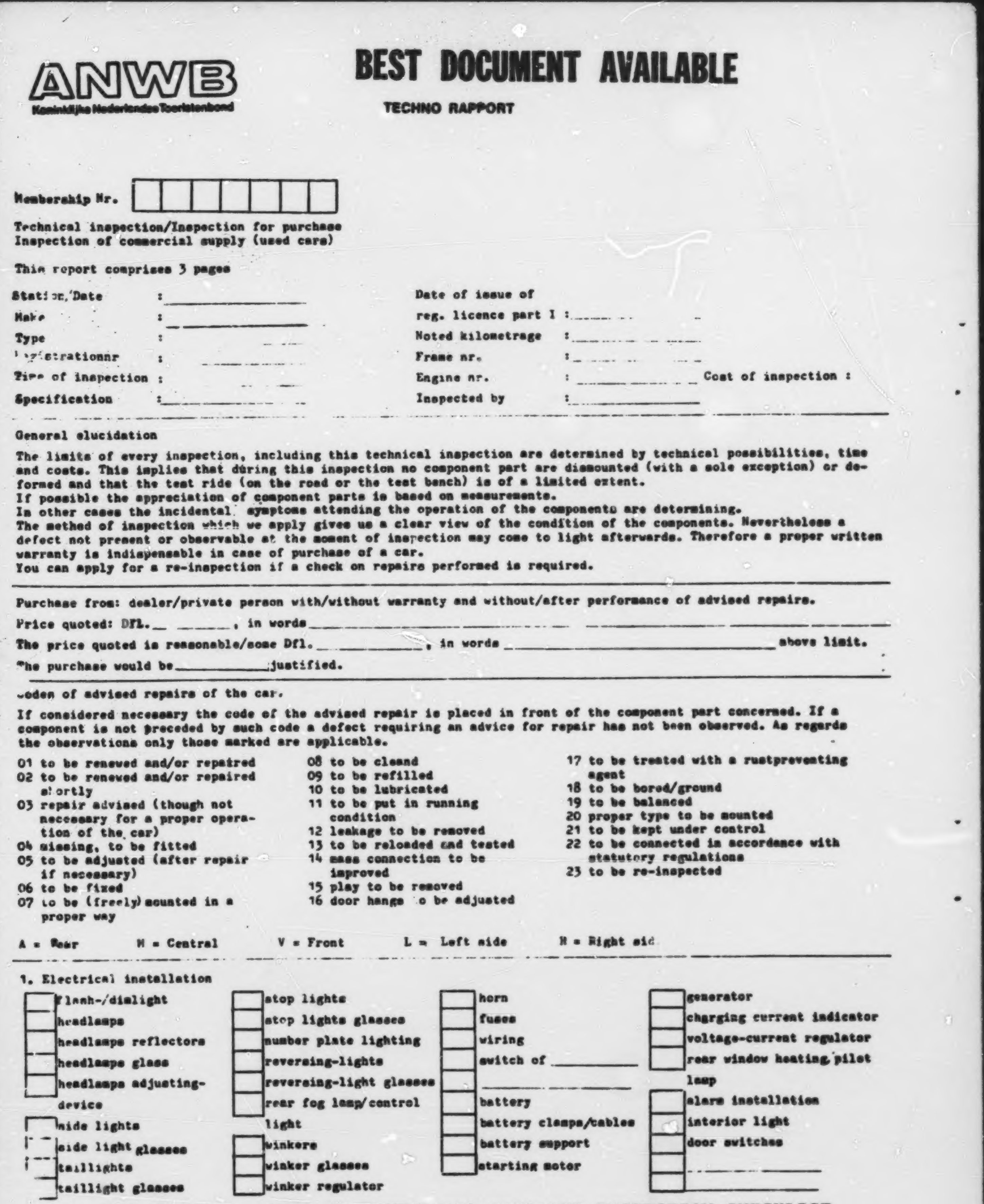

ANWB

Koninklijke Nederlandse Toeristenbond

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TECHNO RAPPORT

Membership Nr. ☐☐☐☐☐☐☐

Technical inspection/Inspection for purchase
Inspection of commercial supply (used cars)

This report comprises 3 pages

Station/Date : ______________
Make : ______________
Type : ______________
Registrationnr : ______________
Time of inspection : ______________
Specification : ______________

Date of issue of reg. licence part I : ______________
Noted kilometrage : ______________
Frame nr. : ______________
Engine nr. : ______________ **Cost of inspection :**
Inspected by : ______________

General elucidation

The limits of every inspection, including this technical inspection are determined by technical possibilities, time and costs. This implies that during this inspection no component part are dismounted (with a sole exception) or deformed and that the test ride (on the road or the test bench) is of a limited extent.
If possible the appreciation of component parts is based on measurements.
In other cases the incidental symptoms attending the operation of the components are determining.
The method of inspection which we apply gives us a clear view of the condition of the components. Nevertheless a defect not present or observable at the moment of inspection may come to light afterwards. Therefore a proper written warranty is indispensable in case of purchase of a car.
You can apply for a re-inspection if a check on repairs performed is required.

Purchase from: dealer/private person with/without warranty and without/after performance of advised repairs.

Price quoted: Dfl. __________ **, in words** ______________________________

The price quoted is reasonable/some Dfl. __________ **, in words** ______________________________ **above limit.**

The purchase would be __________ **justified.**

Codes of advised repairs of the car.

If considered necessary the code of the advised repair is placed in front of the component part concerned. If a component is not preceded by such code a defect requiring an advice for repair has not been observed. As regards the observations only those marked are applicable.

- **01 to be renewed and/or repaired**
- **02 to be renewed and/or repaired shortly**
- **03 repair advised (though not necessary for a proper operation of the car)**
- **04 missing, to be fitted**
- **05 to be adjusted (after repair if necessary)**
- **06 to be fixed**
- **07 to be (freely) mounted in a proper way**
- **08 to be cleand**
- **09 to be refilled**
- **10 to be lubricated**
- **11 to be put in running condition**
- **12 leakage to be removed**
- **13 to be reloaded and tested**
- **14 mass connection to be improved**
- **15 play to be removed**
- **16 door hangs to be adjusted**
- **17 to be treated with a rustpreventing agent**
- **18 to be bored/ground**
- **19 to be balanced**
- **20 proper type to be mounted**
- **21 to be kept under control**
- **22 to be connected in accordance with statutory regulations**
- **23 to be re-inspected**

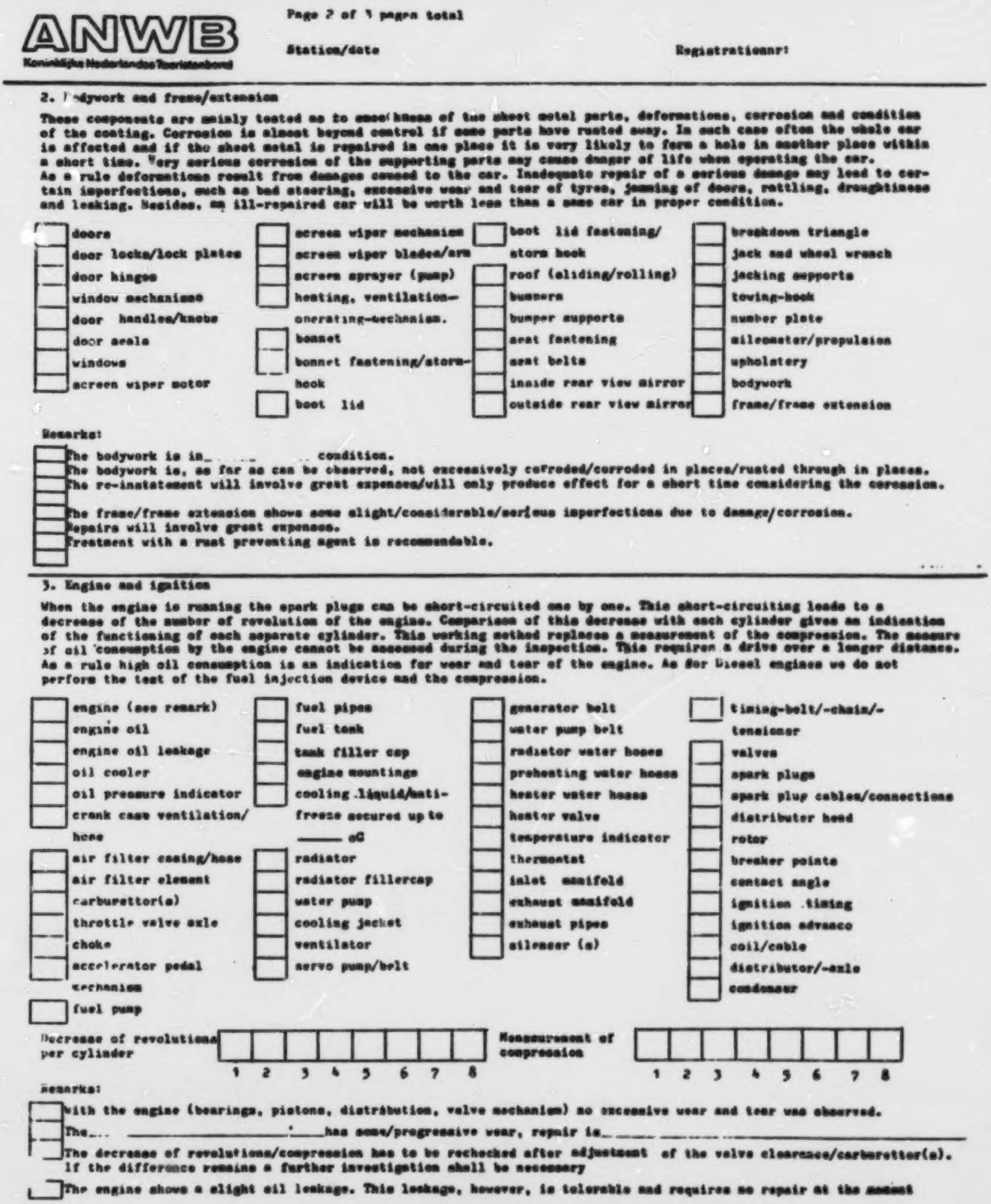
A = Rear **M = Central** **V = Front** **L = Left side** **R = Right sid**

---

1. Electrical installation

- ☐ **flash-/dimlight**
- ☐ **headlamps**
- ☐ **headlamps reflectors**
- ☐ **headlamps glass**
- ☐ **headlamps adjusting-device**
- ☐ **side lights**
- ☐ **side light glasses**
- ☐ **taillights**
- ☐ **taillight glasses**
- ☐ **stop lights**
- ☐ **stop lights glasses**
- ☐ **number plate lighting**
- ☐ **reversing-lights**
- ☐ **reversing-light glasses**
- ☐ **rear fog lamp/control light**
- ☐ **winkers**
- ☐ **winker glasses**
- ☐ **winker regulator**
- ☐ **horn**
- ☐ **fuses**
- ☐ **wiring**
- ☐ **switch of** __________
- ☐ __________
- ☐ **battery**
- ☐ **battery clamps/cables**
- ☐ **battery support**
- ☐ **starting motor**
- ☐ **generator**
- ☐ **charging current indicator**
- ☐ **voltage-current regulator**
- ☐ **rear window heating pilot lamp**
- ☐ **alarm installation**
- ☐ **interior light**
- ☐ **door switches**
- ☐ __________
- ☐ __________

FIGURE E-15. ANWB (NETHERLANDS) COMPLETE INSPECTION CHECKLIST



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Page 2 of 3 pages total

Station/date

Registrationnr:

2. Bodywork and frame/extension

These components are mainly tested as to smoothness of the sheet metal parts, deformations, corrosion and condition of the coating. Corrosion is almost beyond control if some parts have rusted away. In such case often the whole car is affected and if the sheet metal is repaired in one place it is very likely to form a hole in another place within a short time. Very serious corrosion of the supporting parts may cause danger of life when operating the car. As a rule deformations result from damages caused to the car. Inadequate repair of a serious damage may lead to certain imperfections, such as bad steering, excessive wear and tear of tyres, jamming of doors, rattling, draughtiness and leaking. Besides, an ill-repaired car will be worth less than a same car in proper condition.

☐ doors
☐ door locks/lock plates
☐ door hinges
☐ window mechanisms
☐ door handles/knobs
☐ door seals
☐ windows
☐ screen wiper motor

☐ screen wiper mechanism
☐ screen wiper blades/arm
☐ screen sprayer (pump)
☐ heating, ventilation-operating-mechanism.
☐ bonnet
☐ bonnet fastening/storm-hook
☐ boot lid

☐ boot lid fastening/storm hook
☐ roof (sliding/rolling)
☐ bumpers
☐ bumper supports
☐ seat fastening
☐ seat belts
☐ inside rear view mirror
☐ outside rear view mirror

☐ breakdown triangle
☐ jack and wheel wrench
☐ jacking supports
☐ towing-hook
☐ number plate
☐ mileometer/propulsion
☐ upholstery
☐ bodywork
☐ frame/frame extension

Remarks:

☐ The bodywork is in_ ... . condition.
☐ The bodywork is, as far as can be observed, not excessively corroded/corroded in places/rusted through in places.
☐ The re-instatement will involve great expenses/will only produce effect for a short time considering the corrosion.
☐
☐ The frame/frame extension shows some slight/considerable/serious imperfections due to damage/corrosion.
☐ Repairs will involve great expenses.
☐ Treatment with a rust preventing agent is recommendable.
☐

3. Engine and ignition

When the engine is running the spark plugs can be short-circuited one by one. This short-circuiting leads to a decrease of the number of revolution of the engine. Comparison of this decrease with each cylinder gives an indication of the functioning of each separate cylinder. This working method replaces a measurement of the compression. The measure of oil consumption by the engine cannot be assessed during the inspection. This requires a drive over a longer distance. As a rule high oil consumption is an indication for wear and tear of the engine. As for Diesel engines we do not perform the test of the fuel injection device and the compression.

☐ engine (see remark)
☐ engine oil
☐ engine oil leakage
☐ oil cooler
☐ oil pressure indicator
☐ crank case ventilation/hose
☐ air filter casing/hose
☐ air filter element
☐ carburettor(s)
☐ throttle valve axle
☐ choke
☐ accelerator pedal mechanism
☐ fuel pump

☐ fuel pipes
☐ fuel tank
☐ tank filler cap
☐ engine mountings
☐ cooling liquid/anti-freeze secured up to ______ oC
☐ radiator
☐ radiator fillercap
☐ water pump
☐ cooling jacket
☐ ventilator
☐ servo pump/belt

☐ generator belt
☐ water pump belt
☐ radiator water hoses
☐ preheating water hoses
☐ heater water hoses
☐ heater valve
☐ temperature indicator
☐ thermostat
☐ inlet manifold
☐ exhaust manifold
☐ exhaust pipes
☐ silencer (s)

☐ timing-belt/-chain/-tensioner
☐ valves
☐ spark plugs
☐ spark plug cables/connections
☐ distributor head
☐ rotor
☐ breaker points
☐ contact angle
☐ ignition timing
☐ ignition advance
☐ coil/cable
☐ distributor/-axle
☐ condenser

Decrease of revolutions per cylinder	1	2	3	4	5	6	7	8

Measurement of compression	1	2	3	4	5	6	7	8

Remarks:

☐ With the engine (bearings, pistons, distribution, valve mechanism) no excessive wear and tear was observed.
☐ The... ______________ ____has some/progressive wear, repair is_______________________
☐ The decrease of revolutions/compression has to be rechecked after adjustment of the valve clearance/carburettor(s). If the difference remains a further investigation shall be necessary
☐ The engine shows a slight oil leakage. This leakage, however, is tolerable and requires no repair at the moment

FIGURE E-15. ANWB INSPECTION CHECKLIST CONTINUED

[redacted]

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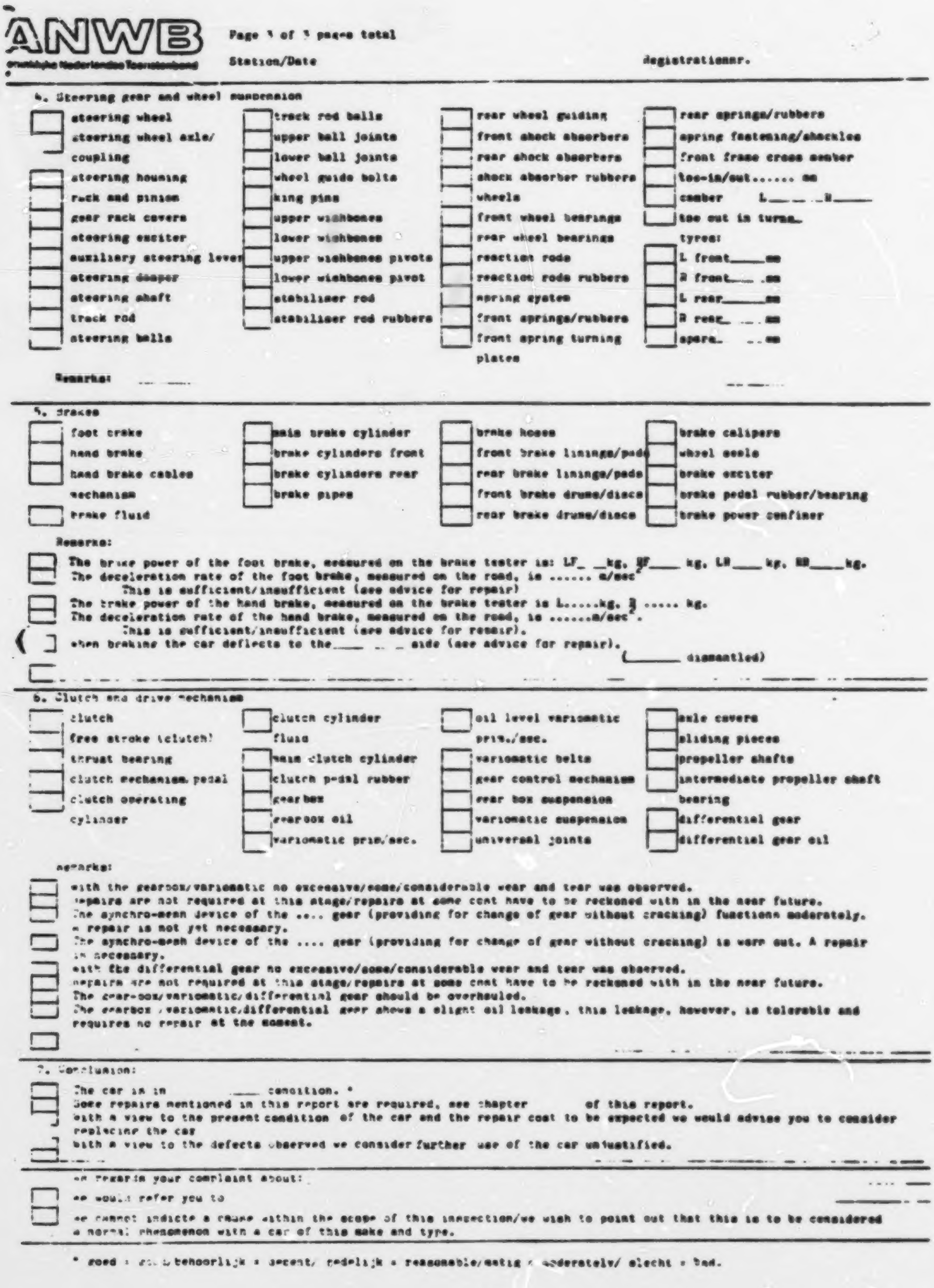

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Page 3 of 3 pages total
Station/Date
Registrationnr.

4. Steering gear and wheel suspension

☐ steering wheel
☐ steering wheel axle/coupling
☐ steering housing
☐ rack and pinion
☐ gear rack covers
☐ steering exciter
☐ auxiliary steering lever
☐ steering damper
☐ steering shaft
☐ track rod
☐ steering balls

☐ track rod balls
☐ upper ball joints
☐ lower ball joints
☐ wheel guide bolts
☐ king pins
☐ upper wishbones
☐ lower wishbones
☐ upper wishbones pivots
☐ lower wishbones pivot
☐ stabiliser rod
☐ stabiliser rod rubbers

☐ rear wheel guiding
☐ front shock absorbers
☐ rear shock absorbers
☐ shock absorber rubbers
☐ wheels
☐ front wheel bearings
☐ rear wheel bearings
☐ reaction rods
☐ reaction rods rubbers
☐ spring system
☐ front springs/rubbers
☐ front spring turning plates

☐ rear springs/rubbers
☐ spring fastening/shackles
☐ front frame cross member
☐ toe-in/out...... mm
☐ camber L____ R____
☐ toe out in turns_
tyres:
☐ L front____mm
☐ R front____ .mm
☐ L rear_____mm
☐ R rear_ __.mm
☐ spare_ __mm

Remarks: ___ ___

5. Brakes

☐ foot brake
☐ hand brake
☐ hand brake cables mechanism
☐ brake fluid

☐ main brake cylinder
☐ brake cylinders front
☐ brake cylinders rear
☐ brake pipes

☐ brake hoses
☐ front brake linings/pads
☐ rear brake linings/pads
☐ front brake drums/discs
☐ rear brake drums/discs

☐ brake calipers
☐ wheel seals
☐ brake exciter
☐ brake pedal rubber/bearing
☐ brake power confiner

Remarks:

☐ The brake power of the foot brake, measured on the brake tester is: LF_ __kg, RF____ kg, LR____ kg, RR____kg.
☐ The deceleration rate of the foot brake, measured on the road, is ...... m/sec^2
This is sufficient/insufficient (see advice for repair)
☐ The brake power of the hand brake, measured on the brake tester is L.....kg, R ..... kg.
☐ The deceleration rate of the hand brake, measured on the road, is ......m/sec^2.
This is sufficient/insufficient (see advice for repair).
☐ when braking the car deflects to the____ __ _ side (see advice for repair).
(______ dismantled)
☐

6. Clutch and drive mechanism

☐ clutch
☐ free stroke (clutch)
☐ thrust bearing
☐ clutch mechanism pedal
☐ clutch operating cylinder

☐ clutch cylinder fluid
☐ main clutch cylinder
☐ clutch pedal rubber
☐ gear box
☐ gearbox oil
☐ variomatic prim./sec.

☐ oil level variomatic prim./sec.
☐ variomatic belts
☐ gear control mechanism
☐ gear box suspension
☐ variomatic suspension
☐ universal joints

☐ axle covers
☐ sliding pieces
☐ propeller shafts
☐ intermediate propeller shaft bearing
☐ differential gear
☐ differential gear oil

Remarks:

☐ with the gearbox/variomatic no excessive/some/considerable wear and tear was observed.
☐ repairs are not required at this stage/repairs at some cost have to be reckoned with in the near future.
☐ The synchro-mesh device of the .... gear (providing for change of gear without cracking) functions moderately. A repair is not yet necessary.
☐ The synchro-mesh device of the .... gear (providing for change of gear without cracking) is worn out. A repair is necessary.
☐ with the differential gear no excessive/some/considerable wear and tear was observed.
☐ repairs are not required at this stage/repairs at some cost have to be reckoned with in the near future.
☐ The gear-box/variomatic/differential gear should be overhauled.
☐ The gearbox /variomatic/differential gear shows a slight oil leakage, this leakage, however, is tolerable and requires no repair at the moment.
☐

7. Conclusion:

☐ The car is in ____ condition. *
☐ Some repairs mentioned in this report are required, see chapter of this report.
☐ with a view to the present condition of the car and the repair cost to be expected we would advise you to consider replacing the car
☐ with a view to the defects observed we consider further use of the car unjustified.

we regards your complaint about:
☐ we would refer you to
☐ we cannot indicate a cause within the scope of this inspection/we wish to point out that this is to be considered a normal phenomenon with a car of this make and type.

* goed = good/behoorlijk = decent/ redelijk = reasonable/matig = moderately/ slecht = bad.

FIGURE E-15. ANWB INSPECTION CHECKLIST CONTINUED

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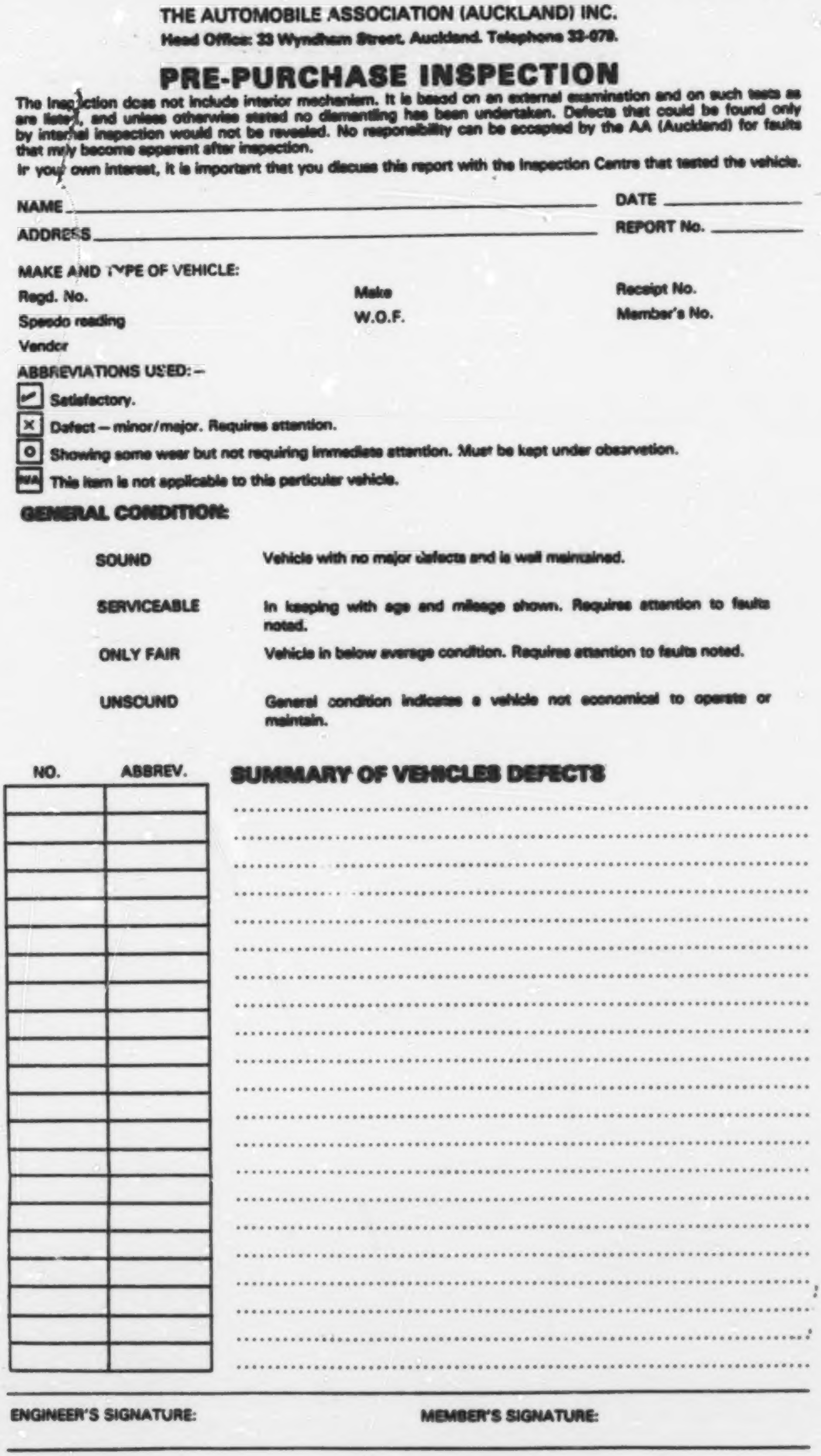

THE AUTOMOBILE ASSOCIATION (AUCKLAND) INC.
Head Office: 33 Wyndham Street, Auckland. Telephone 33-079.

PRE-PURCHASE INSPECTION

The Inspection does not include interior mechanism. It is based on an external examination and on such tests as are listed, and unless otherwise stated no dismantling has been undertaken. Defects that could be found only by internal inspection would not be revealed. No responsibility can be accepted by the AA (Auckland) for faults that may become apparent after inspection.

In your own interest, it is important that you discuss this report with the Inspection Centre that tested the vehicle.

NAME ______________________ DATE ____________

ADDRESS ______________________ REPORT No. ____________

MAKE AND TYPE OF VEHICLE:

Regd. No. | Make | Receipt No.
Speedo reading | W.O.F. | Member's No.
Vendor

ABBREVIATIONS USED: –

- ✓ Satisfactory.
- ☒ Defect – minor/major. Requires attention.
- ⊡ Showing some wear but not requiring immediate attention. Must be kept under observation.
- N/A This item is not applicable to this particular vehicle.

GENERAL CONDITION:

SOUND	Vehicle with no major defects and is well maintained.
SERVICEABLE	In keeping with age and mileage shown. Requires attention to faults noted.
ONLY FAIR	Vehicle in below average condition. Requires attention to faults noted.
UNSOUND	General condition indicates a vehicle not economical to operate or maintain.

NO.	ABBREV.

SUMMARY OF VEHICLES DEFECTS

ENGINEER'S SIGNATURE: MEMBER'S SIGNATURE:

FIGURE E-16. PRE-PURCHASE INSPECTION CHECKLIST FOR NEW ZEALAND AUTOMOBILE ASSOCIATION AT AUKLAND

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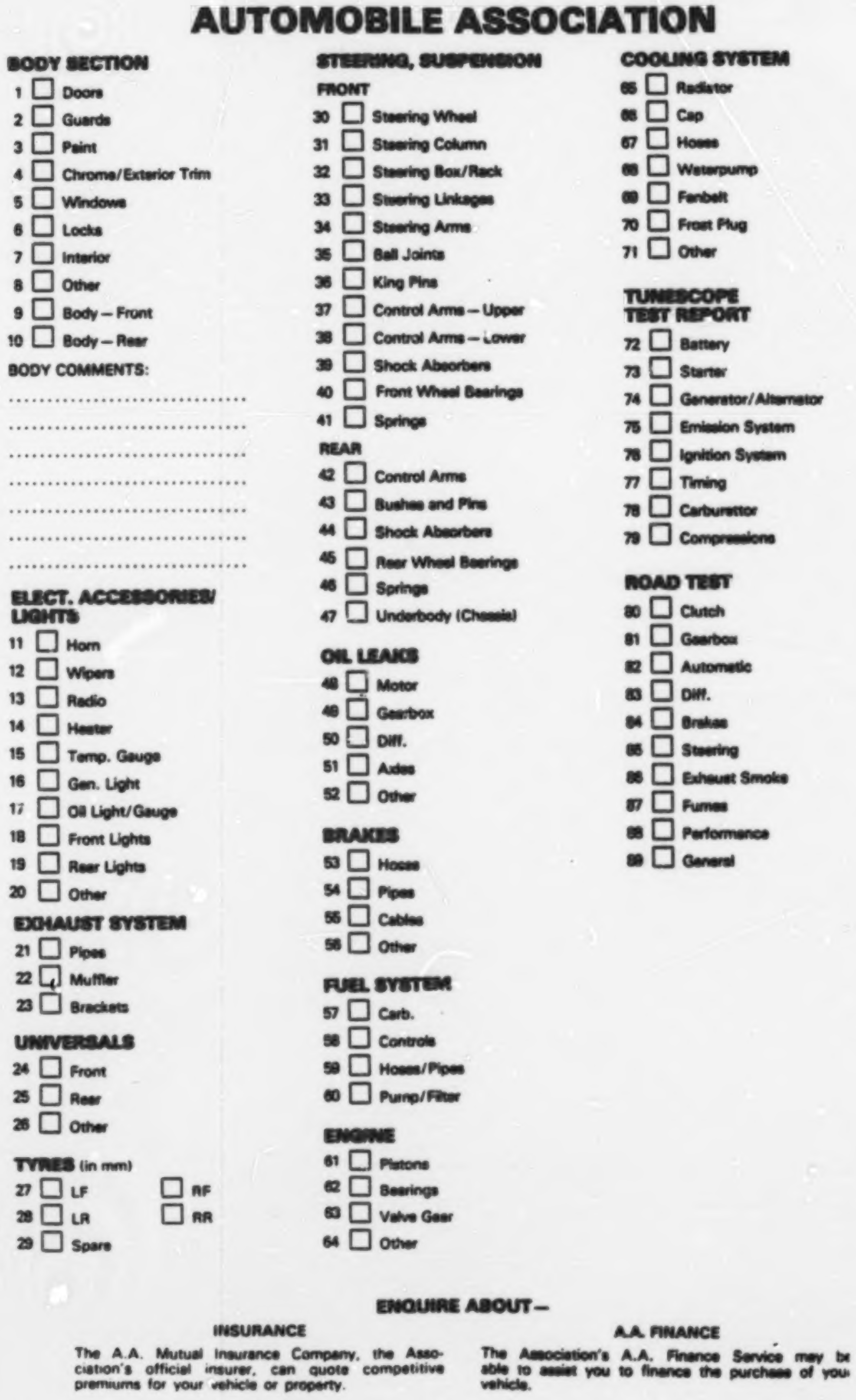

AUTOMOBILE ASSOCIATION

BODY SECTION

1 ☐ Doors
2 ☐ Guards
3 ☐ Paint
4 ☐ Chrome/Exterior Trim
5 ☐ Windows
6 ☐ Locks
7 ☐ Interior
8 ☐ Other
9 ☐ Body – Front
10 ☐ Body – Rear

BODY COMMENTS:

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....
....
....
....
....

ELECT. ACCESSORIES/ LIGHTS

11 ☐ Horn
12 ☐ Wipers
13 ☐ Radio
14 ☐ Heater
15 ☐ Temp. Gauge
16 ☐ Gen. Light
17 ☐ Oil Light/Gauge
18 ☐ Front Lights
19 ☐ Rear Lights
20 ☐ Other

EXHAUST SYSTEM

21 ☐ Pipes
22 ☐ Muffler
23 ☐ Brackets

UNIVERSALS

24 ☐ Front
25 ☐ Rear
26 ☐ Other

TYRES (in mm)

27 ☐ LF ☐ RF
28 ☐ LR ☐ RR
29 ☐ Spare

STEERING, SUSPENSION

FRONT

30 ☐ Steering Wheel
31 ☐ Steering Column
32 ☐ Steering Box/Rack
33 ☐ Steering Linkages
34 ☐ Steering Arms
35 ☐ Ball Joints
36 ☐ King Pins
37 ☐ Control Arms – Upper
38 ☐ Control Arms – Lower
39 ☐ Shock Absorbers
40 ☐ Front Wheel Bearings
41 ☐ Springs

REAR

42 ☐ Control Arms
43 ☐ Bushes and Pins
44 ☐ Shock Absorbers
45 ☐ Rear Wheel Bearings
46 ☐ Springs
47 ☐ Underbody (Chassis)

OIL LEAKS

48 ☐ Motor
49 ☐ Gearbox
50 ☐ Diff.
51 ☐ Axles
52 ☐ Other

BRAKES

53 ☐ Hoses
54 ☐ Pipes
55 ☐ Cables
56 ☐ Other

FUEL SYSTEM

57 ☐ Carb.
58 ☐ Controls
59 ☐ Hoses/Pipes
60 ☐ Pump/Filter

ENGINE

61 ☐ Pistons
62 ☐ Bearings
63 ☐ Valve Gear
64 ☐ Other

COOLING SYSTEM

65 ☐ Radiator
66 ☐ Cap
67 ☐ Hoses
68 ☐ Waterpump
69 ☐ Fanbelt
70 ☐ Frost Plug
71 ☐ Other

TUNESCOPE TEST REPORT

72 ☐ Battery
73 ☐ Starter
74 ☐ Generator/Alternator
75 ☐ Emission System
76 ☐ Ignition System
77 ☐ Timing
78 ☐ Carburettor
79 ☐ Compressions

ROAD TEST

80 ☐ Clutch
81 ☐ Gearbox
82 ☐ Automatic
83 ☐ Diff.
84 ☐ Brakes
85 ☐ Steering
86 ☐ Exhaust Smoke
87 ☐ Fumes
88 ☐ Performance
89 ☐ General

ENQUIRE ABOUT –

INSURANCE

The A.A. Mutual Insurance Company, the Association's official insurer, can quote competitive premiums for your vehicle or property.

A.A. FINANCE

The Association's A.A. Finance Service may b able to assist you to finance the purchase of you vehicle.

BEST DOCUMENT AVAILABLE

FIGURE E-16. NEW ZEALAND A.A. INSPECTION CHECKLIST CONTINUED